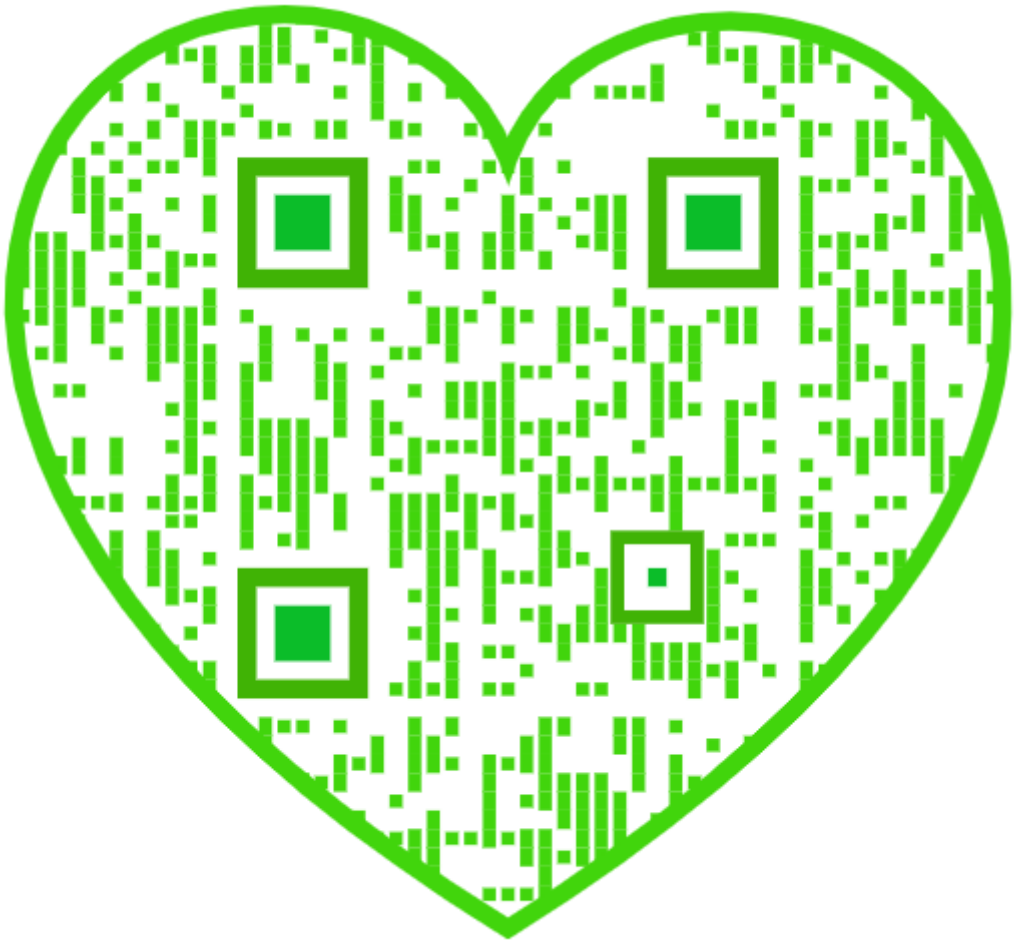

NEW-WORLD HEALTH SERIES

BOOK I

PRIMER OF HYGIENE

BEING A SIMPLE TEXTBOOK ON PERSONAL HEALTH AND HOW TO KEEP IT

BY

JOHN W. RITCHIE

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HERMANN HEYER

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1913

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PREFACE

In comparatively recent years there has come into the world a new knowledge that is able to save man from a great part of the sickness that has heretofore afflicted him. Up to the present time, however, no way of getting this knowledge to the mass of the people has been found, and according to the estimate of Professor Irving Fisher, we have in the United States at all times about three millions of persons who are seriously ill.

The writers of this little book have felt that the greatest immediate service our schools can perform is to put their pupils into possession of those facts that will relieve the people of the great burden of preventable disease which they are now carrying. They believe that hygiene should be faithfully taught in every schoolroom in the land, that the purpose in teaching it is to prevent sickness, and that any text on hygiene that fails to emphasize the facts that modern medicine has shown to be vital in health preservation is an inferior book for school use.

For the valuable suggestions made by those who have read and criticised the proofs of this book, acknowledgment is here made. It is impossible to name all who have aided in this way, but among those whose help has been especially valuable are the following: Leonard P. Ayres, Dr. L. B. Bibb, Dr. H. M. Bracken, Dr. William H. Burnham, Dr. C. Ward Crampton, Dr. S. J. Crumbine, Dr. Martin

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The Oral Hygiene Committee of the National Dental Association, through Dr. W. G. Ebersole, Dr. W. A. White, and especially Dr. Paul G. White, chairman of the text book committee, has given help for which grateful acknowledgment is made

To Miss Florence Gray, Yonkers, New York; Miss Mary Pierce and Miss Frances Dunn, Farmville, Virginia; Miss Virginia Jones, Williamsburg, Virginia; and Miss Jessie B. Montgomery, Terre Haute, Indiana, who gave the book the invaluable test of actual use in the schoolroom, the authors are greatly indebted.

Other practical and experienced teachers who read the proof and gave helpful suggestions were Miss Josephine K. Bauer, Indianapolis, Indiana; Frank Evans, Spartanburg, South Carolina; Miss Minnie Fisher, Montgomery, Alabama; Miss Mary P. Jones, Nashville, Tennessee; Mrs. John L. Price, Florence, Alabama; and Miss Flora Wilber, Fort Wayne, Indiana.

CONTENTS

CHAPTER		PAGE
I.	The Importance of Keeping the Body in Health	1
II.	The Human Body and the Great Laws of Health	5
III.	Foods and their Uses in the Body	9
IV.	Buying Foods	15
V.	Cooking Foods	19
VI.	Caring for Foods	22
VII.	The Digestive Organs and their Work	26
VIII.	Keeping the Digestive Organs in Health	32
IX.	The Care of the Teeth	38
X.	The Air we Breathe	46
XI.	The Lungs and Air Passages and their Care	52
XII.	Adenoids and Enlarged Tonsils	59
XIII.	The Blood and the Heart	63
XIV.	The Kidneys	69
XV.	The Skin	71
XVI.	Clothing	77
XVII.	The Carriage of the Body	81
XVIII.	Exercise	86
XIX.	The Nervous System	90
XX.	The Care of the Nervous System	94
XXI.	The Importance of Habit	98
XXII.	The Effects of Alcohol on the Body	103
XXIII.	The Effects of Tobacco on the Body	110
XXIV.	The Eyes and their Care	113
XXV.	The Ear and its Care	121
XXVI.	Accidents	127
XXVII.	Some Simple Exercises for Use in Schools	131
XXVIII.	Disease Germs	141
XXIX.	Typhoid Fever	144

CONTENTS

CHAPTER		PAGE
XXX.	TUBERCULOSIS (CONSUMPTION)	150
XXXI.	OTHER DISEASES OF THE AIR PASSAGES AND LUNGS	157
XXXII.	MALARIA, SMALLPOX, AND OTHER GERM DISEASES	163
XXXIII.	PREVENTING THE SPREAD OF DISEASE GERMS	168
XXXIV.	KEEPING UP THE RESISTANCE OF THE BODY TO DISEASE GERMS	176
TO THE TEACHER		180
INDEX		181

PRIMER OF HYGIENE

CHAPTER ONE

THE IMPORTANCE OF KEEPING THE BODY IN HEALTH

FIG. 1. When we have health we find the world a beautiful place in which to live.

ALL of us know that this is a beautiful and a pleasant world. We enjoy the songs of the birds and the beauty of the flowers. It gives us pleasure to feel the soft winds of spring and to watch the green come back on the trees. We love to watch the clouds sail through the sky and the snowflakes fall through the air. Everywhere we turn we find many things that give us happiness and contentment, and make the world a beautiful place for us to live in.

Why is it that we cannot spend all our time enjoying the pleasant and beautiful things of life?

Why must we take life so seriously? Why must older people work, and why must children study and prepare themselves for work? We will tell you the great reason why every one who wishes to enjoy the pleasant things of life cannot give all his time and thought to these same beautiful and pleasant things. *It is because we must have health to enjoy the world, and we must work to care for our bodies and to keep them in health.*

The health of the body important. Nature has given to each of us a body, and in these bodies we must live as long as we are in the world. When our bodies are well and strong, we rejoice in them, and we see and feel the beauty of the world. But when sickness and pain come upon us, we can get little pleasure from all the things that have been provided for our enjoyment. This is why we must care for our bodies if we would enjoy the pleasures of life and do the work that is waiting in the world for each one of us.

Work required to keep our bodies in health. To care for the body is not easy, for it must have food, it must be protected from cold, and it must have many other wants supplied. Indeed, so difficult is it to supply all the needs of our bodies that the human race spends most of its time working to secure those things that are necessary for life and comfort. Yet our bodies must be cared for; otherwise we can neither get out of the world the happiness that it

ought to hold for us, nor give to others the pleasure that our lives ought to bring to them.

Hygiene important because it teaches how to care for the body. It is the purpose of this book to teach you how to care for your body and keep it in health. The study of this subject is called *hygiene.* It is a most important subject to you — so important that if you cannot afford to take time to study it and understand it, there are few things that you can afford to take time to do.

Questions: 1. Why cannot we give all our time to enjoying the pleasant things of the world? 2. Explain why it is so important for us to care for our bodies. 3. What is hygiene? 4. Why is the study of hygiene important?

Suggestions and topics for development: Let the teacher and pupils keep an account of the number of days that are lost by the school or grade during the year on account of sickness.

When any one is ill, record the cause of the sickness and determine if possible whether or not it could have been prevented. At the end of the year count up how many days of sickness could have been prevented by reasonable care.

The teacher should secure from the Secretary of the Committee of One Hundred on National Health, New Haven, Connecticut, Professor Irving Fisher's "Report on National Vitality, Its Wastes and Conservation." This pamphlet contains a wealth of information in regard to the whole subject of health and disease prevention. It is important that both teacher and pupil understand that in a young person health is the natural condition; that sickness in such a person is unnatural; and that the cause of sickness in a young person should at once be looked for.

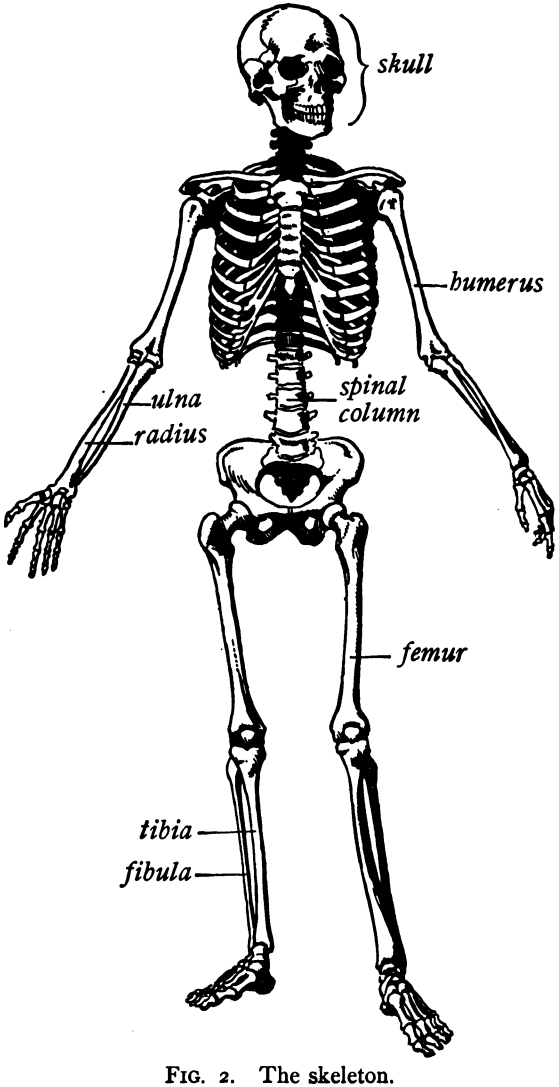


FIG. 2. The skeleton.

CHAPTER TWO

THE HUMAN BODY AND THE GREAT LAWS OF HEALTH

A GREAT engine is made of many different parts all put together to make one machine. So is the human body made of many different parts all joined together to make one whole. The engineer must know when his engine needs coal and water and how to supply them. So we must understand the needs of our bodies and how to satisfy these needs. The engineer must know how to keep sand and dirt out of the working parts of the engine and how to oil these parts so that they will not wear each other away. So we must know how to keep out of our bodies the germs that cause disease and how to give our bodies the exercise and rest that are necessary for their health. In this chapter we shall study the parts of the body, the needs of the body, and the great laws we must observe to keep our bodies in health.

The parts of the human body. The human body is composed of a head, a trunk, and two pairs of limbs. It is supported by a strong framework of bones on which the whole body is built. The muscles to move this framework of bones are stretched over it in strong bands, and the skin forms a tough covering over the whole body.

The organs of the body. The bones and muscles form a thick wall about a large cavity in the trunk of the body. In this cavity are found

many of the organs that do the work of the body. In the upper part of the cavity we find the heart and lungs. In its lower part are the stomach, the

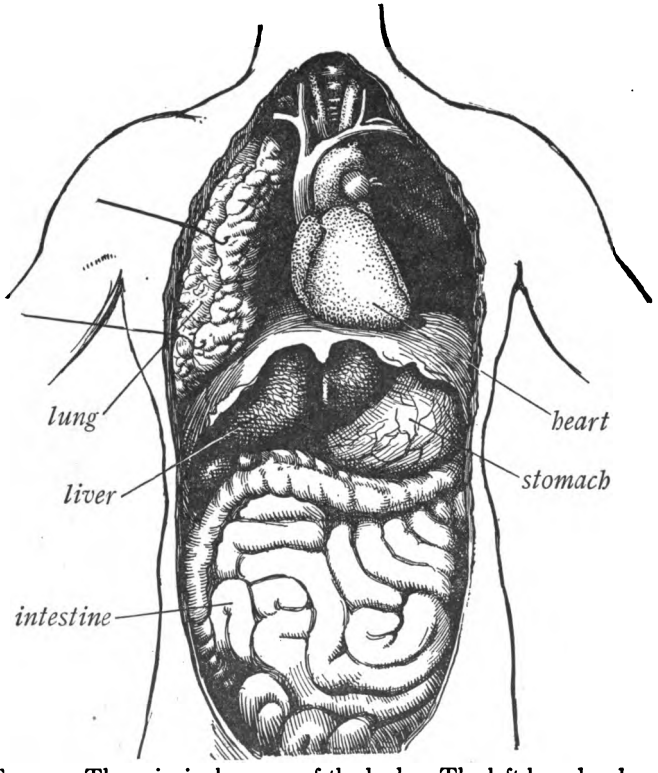


FIG. 3. The principal organs of the body. The left lung has been removed and the edge of the right lung turned back to show the heart and blood vessels more clearly.

intestines, the liver, the kidneys, and some other organs. In Figure 3 the organs are shown as they lie in place in the cavity of the trunk.

The uses of the organs. Each part of the body has a work to do. The bones give shape and strength to every part. Without them we should be as limp and shapeless as bags of sand. The muscles move all the body parts, and without the muscles we should be as motionless as trees or stones. The stomach and intestines take in food and prepare it for use; the heart keeps the blood moving through the body; and the lungs take in oxygen from the air. The hand has a work that the foot cannot do, and the eye has a work that the tongue cannot do. In the same way each part of the body has a work of its own that can be done by no other part.

The great laws of health. For an engineer to understand the importance of taking care of his engine is not enough; he must also know how to do it. So, if we hope to have strong, healthy bodies, we must not only understand the importance of keeping the laws of health, but we must know what these laws are and how we can keep them.

One of the great laws of health is that the body must have a proper supply of food. Another is that it must have an abundance of fresh air. A third is that the body must get rid of its poisonous wastes; a fourth law is that it must be sheltered from the weather so that it will not be too hot or too cold; and a fifth, that it must have exercise, rest, and sleep. Still another law, and a very important one,

is that disease germs must not be allowed to get into the body and poison it.

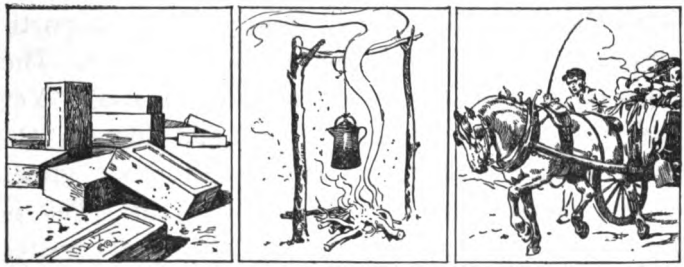
Every one of these laws must be followed if we are to keep our health and our strength; for so surely as an apple falls to the earth when its stem is separated from the tree, so surely is your body injured when the great laws of its life are broken. In later chapters of this book we shall discuss each of these laws and point out how each may best be followed.

Questions: 1. Name the principal divisions of the body. 2. What forms the framework of the body? 3. What is stretched over the framework of the body to move it? 4. With what is the body covered? 5. What organs are in the upper part of the cavity of the body? 6. In the lower part? 7. What is the work of the bones? 8. Of the muscles? 9. Of the stomach and intestines? 10. Of the heart? 11. Of the lungs? 12. Name some other organs of the body and tell what they do. 13. Give some of the great laws of health. 14. What will happen to us if we break these laws?

Suggestions and topics for development: Develop the idea of the interdependence of the body parts. Use the fable of the hands that grew tired of seeking food for the lazy stomach, but found that when the stomach was not supplied with food, the hands and all the other parts of the body became weak and helpless.

CHAPTER THREE

FOODS AND THEIR USES IN THE BODY



FIGS. 4, 5, and 6. Foods furnish the body with building material, heat, and strength.

WHEN a person goes without food for more than a few hours, he feels hungry. This means that his body needs food and is calling for it. If the person cannot get food, he will soon become weak and his body will waste away. Without food we cannot keep our health and strength. Without food we cannot even live.

Do you ever wonder why it is that you want to eat? Why one food is sometimes better for us than another food? Why a proper amount of food will give strength to the body and too much food will make the body ill? Why physicians are continually telling us to be careful about what we eat and insisting that a great part of our sickness comes from improper food? These questions are most important to us, and we shall therefore study foods and the uses that the body makes of them.

Foods necessary for building materials. Scrape the skin of your arm with a knife. Do you not find

dead, dry scales on the knife? This dead material is all the time falling away from the skin, as particles of bark drop from the outside of a tree. The inner parts of your body also are wasting away. Yet your body does not become lighter and thinner. On the contrary, with young persons the body grows larger and becomes heavier year by year. This is because every particle of substance that wastes away in heart or muscle or brain or skin is replaced by new materials, and at the same time new substance is built up for making the body larger. This new material is formed from the food that we eat. *One great use of food is to furnish building material to the body.*

The building foods. Among the more important building foods are lean meats, milk, and eggs. Bread and grains also contain large amounts of building materials, as do peas, beans, oats, and corn. These foods give the body warmth and strength, but their main use is to furnish material for growth and repair. They can do this because they are composed of materials like those which make up our bodies. Only such materials can build up our bodies. It would be just as sensible to try to mend a broken window with bricks or to repair a wornout engine with lumps of coal as to try to repair the body with materials different from those of which it is made. Every day we must eat some building food, for night and day, whether

we are asleep or awake, our bodies are wearing away.

Foods necessary to give heat to the body. The body is warmer than most of the objects around it. It is kept warm by the food that we eat just as a stove is kept warm by the wood or coal that is burned in it. *A second use of food is to furnish heat for warming the body.*

Foods necessary to give strength to the body. You have seen a great engine driving hundreds of machines, or you have watched a locomotive as it flew across the country pulling a train behind it. An engine gets its power to work from the coal that is burned in it. In the same way, when you lift something or when you run, your body gets its strength and its power from the food that it uses. *A third use of food is to give the body strength and power to work.*

The heating and strengthening foods. The second class of foods is the heating and strengthening foods. These are the foods that contain the starches and sugars, the fats and the oils. We take sugar into the body mainly in fruits and in the foods to which we add it to improve the taste. Molasses, honey, syrups, and other sweet foods also contain large amounts of sugar.

Starch forms more than three fifths of our food. We eat it mainly in potatoes and in the foods made from grains — wheat bread, corn bread, macaroni,

rice, and breakfast foods. Some starch is found also in such vegetables as turnips and cabbages.

The fats we get chiefly in meats and in butter and milk. We also get fat in food cooked with lard or cotton-seed oil and a little fat in fruits and

FIG. 7. We should eat plain, substantial foods that will supply the body's needs and keep it in health. We should learn in youth to eat these foods, for to a great extent we carry through life the habits of eating that we form when we are young.

vegetables. From a pound of fat or oil the body gets twice as much heat and strength as it gets from a pound of any other kind of food.

Selecting foods that will supply all the body needs. We should eat some building foods and some heating and strengthening foods, so that all the needs of the body may be supplied. Some persons eat so much meat that their bodies have more building material than they can use, while at the same time they have very little starch and sugar. Some

persons dislike fat meats and butter and take only a little fat in their food. It is believed that these persons are more liable to certain diseases, especially to consumption, than are persons who eat a reasonable amount of fat. A few persons seem able to live and keep in health on nuts and fruits, but these foods do not contain enough building material for most persons. Eating too much meat, not eating enough fat, and not eating enough building material are the three most common mistakes in selecting foods.

Learning to eat many different kinds of foods. Nearly all of us like the things that we eat as children, and to a large extent we keep through life the habits of eating formed when we are young. You should therefore eat many different kinds of foods and learn to like them, and guard against falling into the habit of eating only a few things and refusing to taste anything else.

Questions: 1. Name the first use of foods to the body. 2. Why must the body have building materials? 3. Name the more important building foods. 4. Give two other uses of foods in the body. 5. What materials do these foods contain? 6. Name some foods that contain starch. 7. Name some foods that contain sugar. 8. Name the foods from which we obtain fat. 9. For what is fat especially valuable in the body? 10. Name some common mistakes that people make in selecting their food.

Suggestions and topics for development: Whether an animal that stays outdoors in the winter or one that is kept in a warm stable

needs more food, and why. The kind of food eaten by the inhabitants of cold countries, and why. The kind of foods needed in especially large amounts by growing animals and children. Where a chick in an egg gets the lime for building its skeleton. The minerals needed by the body and where they are obtained. How food is stored in the body. Why a person is thin after sickness. What a frog or a bear lives on while it is sleeping through the winter. Why a person who is doing hard work needs large amounts of food.

The teacher should learn as much as possible about the eating habits of the pupils, and if any of them are given to eating large quantities of sweets or lean meats, or are falling into other errors of diet, they should have clearly presented to them the fact that the body demands a balanced ration and that it will not receive such a ration from a diet of this sort.

The teacher who understands chemistry will find profit in reading Chittenden's *The Nutrition of Man*, published by Frederick A. Stokes Company, New York.

CHAPTER FOUR

BUYING FOODS

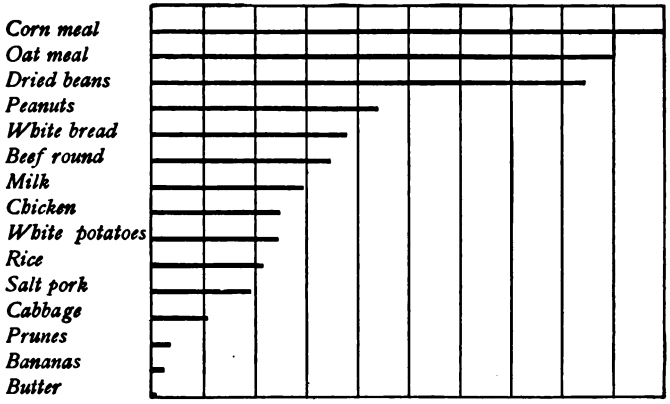


FIG. 8. The length of the line shows the comparative amount of building material in ten cents' worth of each of these foods.

DURING a strike in Chicago a poor woman spent her last ten cents for lettuce to feed her hungry family. If she had bought dried beans, she would have had seventy-one times as much food for the same money; or by spending five cents for bread and five cents for milk she could have taken home to her children forty-one times as much nourishment. She did not understand that the body must have a certain amount of building material and a certain amount of food for heat and strength, and that the various food materials are not equally valuable for these purposes. She had not learned that in mutton a pound of building material costs $1.50, while in corn meal it can be bought for 27

cents; that the amount of heating and strengthening material that can be bought in sugar for 6 cents costs 54 cents in cabbage; that the amount of fat that can be bought in fat salt pork for 10 cents costs in butter 61 cents; that one pound of oatmeal will give as much heat and strength as seventeen pounds of tomatoes or nearly seven pounds of bananas.

How to select foods. It is often a mistake to buy beefsteak at twenty-five cents a pound when for half the money cheaper cuts of meat can be bought that will give as much nourishment or even more. A man who does hard work must have a great deal of the food that gives strength. It is not necessary for him to get his strength from expensive foods like meat and eggs when he can get the same strength at much less cost from bread and potatoes. With only a small amount of money a housekeeper can provide good food for her family by finding out what cheap foods will supply the necessary building material and strength, and then learning how to cook these foods so that they will be pleasant to the taste and will agree with the digestion.

The tables on pages 15 and 17 show the amount of building material and of heat-giving and strength-giving material in some common foods, and the cost of these materials in the different foods.

Questions: 1. What mistake do people often make in buying their food? 2. From the table on page 15 name some foods that contain large amounts of building material.

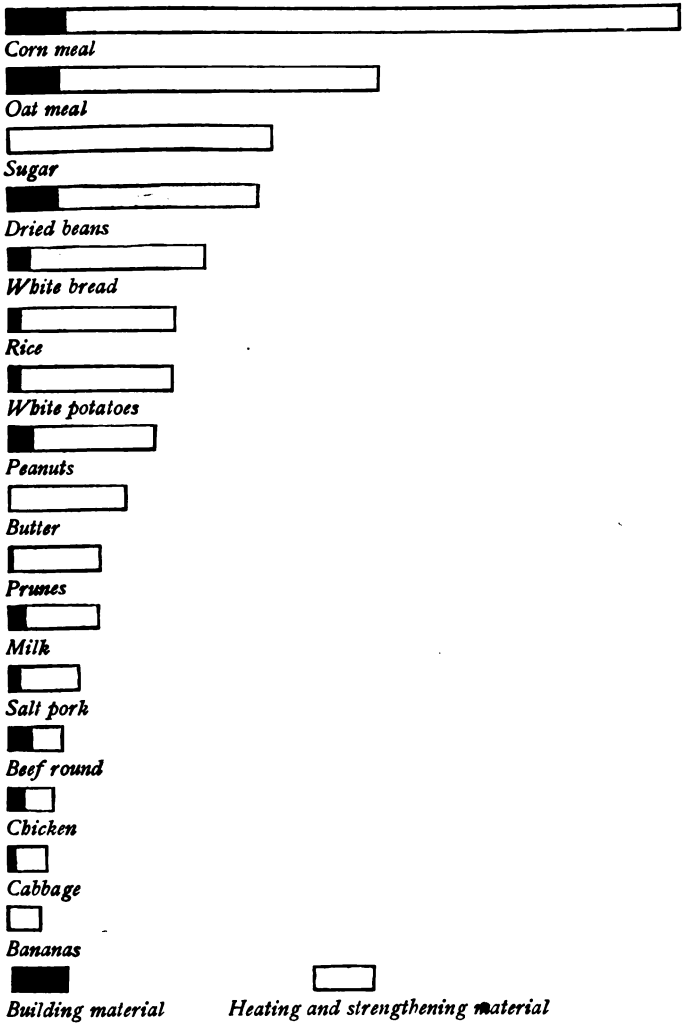


FIG. 9. Showing the value of ten cents' worth of certain foods for supplying building material, heat and strength.

3. Name some foods that are valuable for giving heat and strength to the body. 4. Name some foods that are valuable for building material as well as for heat and strength. 5. What do potatoes supply to the body? 6. What food could a person eat with potatoes to give his body building material, heat, and strength? 7. If a person lives on fruits and vegetables, what does his body lack? 8. From the tables on pages 15 and 17 select a number of foods which furnish building materials at a low price. 9. Select some foods that will furnish heat and strength to the body at a low price. 10. Select foods that will furnish both building materials and heat and strength at a low price. 11. Which should you consider the cheapest food in the list on page 17? 12. The most expensive?

Suggestions and topics for development: The value of breakfast foods; not a substitute for other foods, but an agreeable addition to the regular diet. Discuss with the pupils the nutritive value of commonly used foods. Many American families are underfed, and the pupils should be made to understand the possibility of supplying the needs of the body with low priced foods. Keep in mind the value of those foods that enable us to eat with them large quantities of other cheap foods like bread.

Obtain from the Secretary of Agriculture, Washington, D. C., Farmers' Bulletin No. 391, on the Economical Use of Meat in the Home. In the Appendix to Ritchie's *Human Physiology* (the third book of this series) the analyses and costs of a number of foods are given. A very complete list of the analyses and comparative costs of foods will be found in Bulletin No. 28 of the United States Department of Agriculture. This may be obtained by sending five cents to the Superintendent of Public Documents, Washington, D. C.

CHAPTER FIVE

COOKING FOODS

IT would be hard to think of an article of food more pleasant to the taste and more certain to agree with the digestion than warm, crisp, brown toast, made from light, well-baked bread. It would be hard to think of an article of food more disagreeable to the taste and more ruinous to the health than rolls baked only until the outer part is slightly browned while the inner part of each roll is still a sticky, doughy mass. Yet the toast and the rolls are made from the same materials. The difference is in the way they are cooked.

FIG. 10. This man's work is so important that he sometimes receives a larger salary than is usually paid a lawyer, doctor, minister, or teacher.

The importance of well-cooked food. It has been said that the greatest difference between the food of the rich and the food of the poor is in the cooking. There is much truth in this, for to a very considerable extent we all live on the same foods. It would take a whole book to discuss fully the subject of cooking, and we cannot attempt to do this here. There are, however, two points in regard to cooking that are so important that every one should understand them.

The cooking of starchy foods. Raw starch is in little hard grains that are digested very slowly. When placed in hot water, these grains swell up into a soft mass. This softened starch can then be easily digested. Oatmeal or corn meal that has been cooked for only a short time is very difficult to digest, but if these foods are placed in a double boiler and cooked for several hours they are very easy to digest. Thoroughly baked bread is the "staff of life," and every healthy person can digest it. But half-baked bread, with the starch grains in it almost as hard as little bits of wood, is ruinous to the digestion of any one who is forced to eat it. Vegetables like potatoes, turnips, and cabbages are valuable chiefly for the starch that is in them, and they should be cooked until they become soft and the starch grains in them are broken up.

The use of fats in cooking. Fat is a most valuable heating and strengthening food, but, like every other food, it may injure the body if it is taken in a wrong way or in too large amounts. When fat has been made very hot, as often happens when food is fried, acids that injure the stomach are formed in it. Also, when foods are coated with fat, the digestive juices cannot get at them and they are digested very slowly. For this reason many foods are much harder to digest when fried than when cooked in other ways. Greasy crullers, pancakes, fried pies, and other fried foods are injuring the digestive or-

gans of many people, and the health of many families would improve at once if their frying pans were thrown away.

Questions: 1. Why should starchy foods be well cooked? 2. Name some starchy foods. 3. What injurious substances are formed in fat when it is heated very hot? 4. Why are fried foods harder to digest than foods that are cooked in other ways?

Suggestions and topics for development: One teacher who has come to the attention of the writers of this book has done much for the community in which she is working by discussing with the girls of her school the best ways of cooking different foods, bringing samples of her own cooking to school and having the girls do the same, and in general by showing that she is interested in the best methods of preparing foods for use. Many good books on the subject may be obtained and there are persons in every locality whose methods of cooking are worthy of study and imitation by others. It is not necessary for a teacher to wait for a department of domestic science before making a beginning in this work, and the fact that the teacher considers the subject of sufficient importance to receive serious consideration will in itself have a most wholesome effect on the mental attitudes of the pupils. Discuss methods of cooking some of the cheaper foods so that they will be acceptable substitutes for those that are more expensive. Farmers' Bulletins from the United States Department of Agriculture that will be found useful are No. 34 on Meats: Composition and Cooking; No. 112 on Bread and Bread Making; No. 256 on the Preparation of Vegetables for the Table; No. 359 on Canning Vegetables in the Home. These Bulletins will be sent without cost to anyone who applies for them.

CHAPTER SIX

CARING FOR FOODS

FIG. 11. Foods should be kept away from the hands of the public and from dust and flies.

IF a piece of meat is left in a warm place, it will soon spoil. But if it is thoroughly cooked and tightly sealed up in a can, it will keep for years. Or if it is placed where it will remain frozen, it will not decay. Every fisherman or farmer knows that salt helps to keep fish or meat from spoiling, and the housekeeper puts sugar in her fruits to keep them from souring, or to "preserve" them.

What is it that causes food to spoil? Why is it that food will keep if it is canned, or frozen, or heavily salted, or preserved in sugar? What must we do with our foods when we want to keep them from spoiling and becoming unfit for use?

Spoiling of food caused by bacteria. Spoiling and souring of food are caused by *bacteria.* These are plants so very small that we can see them only with a microscope. Some kinds of bacteria

are able to grow in our bodies and cause sickness. These kinds we call disease germs. Many kinds of bacteria that do not cause disease can grow in our foods and cause the foods to spoil so that they become unfit for use. *The important thing in the care of foods is to keep bacteria from growing in them.*

Keeping bacteria out of food by cleanliness. We give bacteria a chance to get into food by allowing dust to blow into it; by allowing flies to crawl over it; by allowing mice, rats, and roaches to run about in pantries; by keeping the food in dirty vessels; by washing it with dirty water; by handling it with unclean hands; and in general by failing to keep it clean. *Cleanliness is the first great point in caring for food, since it keeps bacteria from getting into the food.*

FIG. 12. Food should be kept in a refrigerator, and there should always be enough ice in the refrigerator to keep the food cold.

Keeping bacteria from growing in foods by cold. Bacteria grow very slowly in foods that are kept cold, and by keeping foods cold we can do much to keep them from spoiling. Do not leave in a warm kitchen milk, meats, cooked fruits, or other foods that will spoil, but put them at once into a refrigerator with plenty of ice. If ice cannot be

obtained, food should be bought or cooked only as it can be used, for spoiled food is unfit for use. *Cold is the second great point in the care of food, since it keeps bacteria from growing in the food.*

Killing the bacteria in food with heat. Cooking food kills the bacteria in it and for a time keeps the food from spoiling. Milk vessels and other vessels in which food is kept should be scalded with hot water before they are used. If this is not done, great numbers of bacteria will get into the food from the vessels and will quickly cause it to spoil.

Keeping disease germs out of foods. Persons who are sick and persons who are caring for the sick often have dangerous disease germs on their hands. It is never safe for these persons to handle food, for if the germs get from their hands into the food other people are likely to catch the disease. No one who has consumption or who has lately had typhoid fever should have anything to do with the handling of food.

All foods should be carefully guarded from flies, for the fly is a great carrier of dangerous germs. It need hardly be said that foods that have been handled in an unclean way, or foods that have been fingered over and handled by the public, are far more likely to have disease germs in them than foods that have been kept clean.

The danger in using food preservatives. There are many acids and other substances that will prevent the growth of bacteria in milk and other

foods, and will keep the foods from spoiling. Some of these are sold in drugstores or by agents and are used by housekeepers, especially in canning fruits. Though some of these substances are harmless, it has been proved that others are poisonous, and their use in foods offered for sale is forbidden by law.

Questions: 1. What causes foods to spoil? 2. What are bacteria? 3. How can food be kept from spoiling? 4. Mention some ways by which bacteria get into food. 5. What is the first great point in caring for food? 6. Why do foods keep longer when they are kept cold? 7. Where should foods be kept? 8. What is the second great point in the care of foods? 9. How can the bacteria in foods be killed? 10. How can the germs on milk vessels and food vessels be killed? 11. Why should this be done? 12. How do disease germs often get into food? 13. Is it wise or unwise to use food preservatives?

Suggestions and topics for development: The importance of proper care of food and food receptacles. Fill small, clean bottles or jars with milk or cooked fruits. Keep one in a warm room, the other in the coldest place possible. Let the children notice which sours first. When both have become sour, empty the bottles, scald one carefully, rinse the other with cold water, and refill. Put them away together and let the children watch for signs of souring.

Good and bad methods of caring for milk. The importance of keeping free from germs the milk given to a baby. The care of school lunches. Foods purchased by school children that are likely to contain large numbers of bacteria. Practical methods of keeping flies out of a kitchen. How to destroy flies and cockroaches. Obtain from the Secretary of Agriculture, Washington, D. C., Farmers' Bulletins 155, How Insects Affect Health; 74, Milk as a Food; and 375, Care of Food in the Home. These are free. Many practical suggestions for the care of foods will be found in them.

CHAPTER SEVEN

THE DIGESTIVE ORGANS AND THEIR WORK

SUPPOSE that you are hungry and hold a piece of bread in your hand. Your brain, your muscles, and all the parts of your body need the bread to nourish them. How can you get the bread to them? By eating it, of course. It may seem strange that the way to the brain is down the throat, but nevertheless this is the road the food travels to get to the brain.

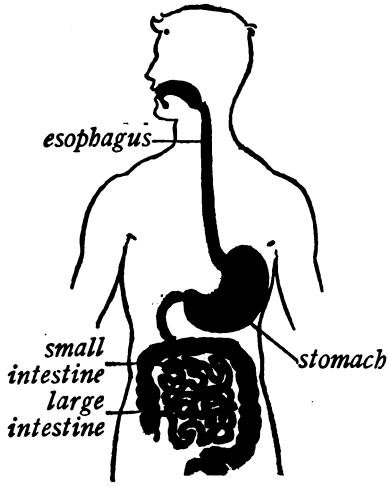


FIG. 13. The alimentary canal.

Is a piece of bread as you hold it in your hand ready to be used by the different parts of the body? Where does it go after you eat it and what happens to it? We speak about digesting our food, but what do we mean by *digestion?* We hear people talk about having trouble with their digestive organs. What organs are these, where are they, what do they do? What difference does it make to us if they do get out of order? In this chapter we shall find the answers to some of these questions.

Where the food goes after it is eaten. After the food is eaten, it passes from the mouth into

the throat, and then into the *esophagus*. At the lower end of the esophagus it enters the stomach, and from the stomach it passes on into the small intestine and the large intestine. As the food passes through this long canal, it is digested and then taken through the wall of the intestine into the blood.

What happens to food during digestion. The food that we eat goes into the stomach in a dough-like mass. Before it can be used by the body, it must soak through the wall of the intestine and get into the blood. To get through this wall, the food must be dissolved. The saliva of the mouth and the juices in the stomach and intestine *act on the foods in such a way as to dissolve them.* The process of dissolving the foods is called *digestion*, and no solid food can get into the blood until it has been digested.

FIG. 14. The salivary glands. Each gland forms saliva and empties it into the mouth through a little tube or duct.

Digestion in the mouth. In the mouth the food is ground into pieces by the teeth, and is mixed with the saliva. The saliva dissolves some of the starch and thus begins the process of digestion. The saliva comes from three pairs of *salivary glands.*

These lie under the tongue, under the back corners of the lower jaw, and in the cheeks below and in front of the ears. Each gland is a little structure that forms saliva and empties it into the mouth through a little tube or duct.

The stomach. After the food has been ground by the teeth and moistened by the saliva, it is swallowed

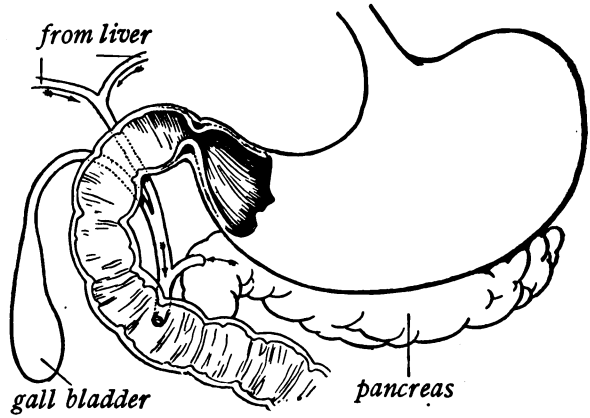


FIG. 15. The stomach.

and passes down into the stomach. One use of the stomach is to serve as a storehouse for food, so that a considerable amount of food can be eaten at one time and kept until the body can use it. The stomach also pours out *gastric juice* on the food. The gastric juice digests a large part of the meat, eggs, and other building foods and gets them ready for use in the body. An acid in the gastric juice kills most of the bacteria that get into the stomach in

food and water, and thus helps to protect us from disease germs.

The liver and the pancreas. The liver, which weighs nearly four pounds, lies on the right side of the body, opposite the stomach. It makes a greenish yellow liquid called *bile.* This liquid flows into the small intestine through a duct from the liver and assists in the digestion of food. The pancreas is a long, flat organ that lies below the stomach. It has a duct that joins the duct from the liver and empties into the small intestine. The juice from the pancreas does a very important part of the work of digesting the foods in the small intestine.

The small intestine. All along the walls of the small intestine are little glands that pour out juices to assist in the digestion of the food. The food moves slowly through the small intestine, which is more than twenty feet long, requiring from ten to twenty hours to complete this part of its journey.

Digestion in the small intestine. After the food passes from the stomach into the small intestine, the juices from the liver and pancreas are poured in with it, and the juices from the intestinal glands also are mixed with it. As the food moves slowly along the intestine, the juices finish the process of digestion. The food then soaks through into the great network of little blood vessels that are in the wall of the intestine, and is carried all through the body. Thus the solid food that we eat is dis-

solved and taken into the body to nourish all its parts.

The large intestine. In all food there is some refuse matter like the woody matter in cabbages and potatoes, the skins of fruits, and the tough fibers of meats. This matter passes on into the large intestine. Nothing is more important to the health than

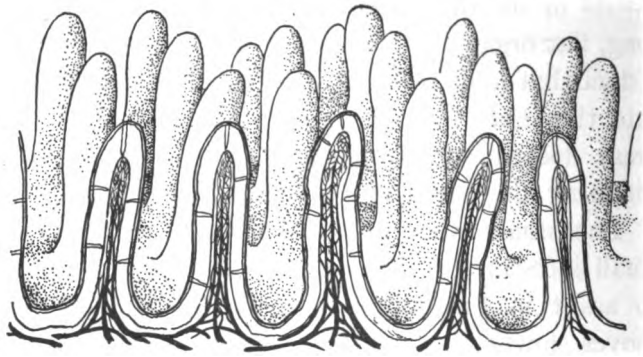


FIG. 16. The lining of the small intestine is thickly covered with little finger-like structures called *villi*. The digested food is absorbed into the blood vessels that are in these structures. The picture shows villi highly magnified.

that this refuse matter be cleared out of the large intestine every day and not allowed to lie in the intestine to sour and decay.

The importance of caring for the digestive organs. The work of digesting the food is so important that the organs that do this work fill nearly the whole cavity of the body. "It is not what we eat but what we digest that makes us strong." This

is an old saying, and it is a true one. We cannot have strong bodies if we do not have healthy digestive organs to prepare food for them. In the next chapter we shall study some ways of keeping the digestive organs in health.

Questions: 1. What do the digestive juices do to the foods during digestion? 2. What digestive juice is found in the mouth? 3. Where does it come from? 4. How many pairs of salivary glands are there? 5. Where are they found? 6. Give two uses of the stomach. 7. What kind of foods does the gastric juice digest? 8. What does the acid in the gastric juice do? 9. Where is the liver found in the body? 10. How large is it? 11. What liquid comes from it? 12. Where in the body is the pancreas? 13. Into what is the juice from the pancreas emptied? 14. How long is the small intestine? 15. What is found along its walls? 16. How long does it take the food to pass through the small intestine? 17. What is happening to the food while it makes this journey? 18. Where does the food go after it has been digested? 19. What part of our food goes on into the large intestine? 20. Why is it important for us to care for our digestive organs?

Suggestions and topics for development: Where the gastric juice comes from, and what habits the pupils have that may interfere with the flow of it. The injury to health resulting from constipation.

Illustrate absorption by showing how salt or sugar dissolved in water will pass through a paper. Show digestion by putting a cube of hard boiled white of egg into a glass of water with a few drops of acid and a little pepsin. The lining of a calf's stomach dried and pulverized may be used instead of pepsin. Prepare materials in another glass in the same way, but first cut the egg into fine pieces to show the advantages of thoroughly chewing food. Set both glasses in a warm place (about 100 degrees is best) for a few hours.

CHAPTER EIGHT

KEEPING THE DIGESTIVE ORGANS IN HEALTH

To a great extent life is colored by the way the digestive organs do their work. One man has a good digestion, and he sees sunshine and success before him. Another is afflicted with dyspepsia, and he expects to meet only clouds and failure on his way. Truly one might almost be led to think that the mind is in the stomach and not in the brain, for we look at the whole world through rose-colored or blue glasses according to the way we succeed in digesting what we eat.

FIG. 17. William Ewart Gladstone, who was called "England's Grand Old Man." He believed that his vigorous old age was in large part due to his habit of cutting his food into small pieces and chewing it thoroughly.

In most cases, troubles of the digestive organs are brought on gradually by improper habits of eating, and in youth every one has it largely in his own power to decide whether he will go into later life with dyspepsia, or with digestive organs that can do their work. In this chapter we shall learn something about caring for these organs, but you must understand that knowing hygienic rules will not improve your health if you do not put these rules into practice. It will do you

no good to understand about the benefits that come from thoroughly chewing your food if you swallow your lunch down in large masses, and if you take alcoholic drinks into your stomach the delicate lining of the stomach will not be protected by anything you have read in a book. It requires *doing* as well as *knowing* to keep the digestive organs in health.

The importance of thoroughly chewing the food. People who make it a rule to chew every mouthful of food into a perfect paste find that their health is very greatly improved by doing so. Just as sugar dissolves more quickly in a glass of water when it is in fine grains than when it is in large, hard lumps, so food ground into bits by the teeth is digested and dissolved more quickly in the stomach and intestine than food that has been swallowed in large pieces. Thorough chewing of the food carries us far on the way to a good digestion, and a good digestion sets us well on the road to good health.

Drinking liquids at meals. A glass of water taken at mealtime in small sips moistens the food and helps to mix the saliva thoroughly with it, thus causing the starch to be more quickly digested. Water taken in larger amounts hinders digestion, especially if the food is washed down without being properly chewed. The water should not be ice cold, because cold drinks chill the stomach and hinder digestion. Coffee and tea hinder the work of the saliva, and these drinks should be used sparingly

by every one and should be avoided entirely by those who have trouble in digesting starchy foods.

Eating too much at one time. Another frequent cause of indigestion is eating too much. Do not overload your stomach by giving it more food than it can digest for hours, for if you do the food will sour in your stomach and you will suffer.

FIG. 18. It is hard for a dyspeptic to be happy and efficient.

Eating a whole meal of one kind of food. Sometimes we find a child who wants to make a whole meal of chicken, green peas, syrup, cake, strawberries, or some other article of food that he particularly likes. Eating in this way throws all the work upon one of the digestive juices while the other juices are idle. This makes the work of digestion go on very slowly, and the food has time to ferment and sour before digestion is finished.

Eating at irregular times. Our digestive organs are ready to digest a meal at the time at which we usually eat. Therefore one should not eat dinner at twelve o'clock one day and at two o'clock the next day. Do not get so busy at your play that you do

not have time to eat, and do not form the habit of eating between meals or whenever you can get something that you like to eat. Have regular hours for your meals and give your digestive organs a chance to rest between meals, for they need time for rest just as much as your muscles do.

Indigestible lunches. Many persons, among them many school children, are ruining their digestions by the kind of lunches that they eat. They are not able to be at home for the noonday meal, and instead of eating a sensible, nourishing lunch, they load their digestive organs with candy, chocolate, pickles, olives, pie, cake, bananas, peanuts, ice cream, soda fountain drinks, or almost anything else they like and can get.

This is the wrong way to select a lunch, and the person who follows this plan must suffer. Candy probably does more harm than any other of these foods. It is composed chiefly of sugar, and when taken in small amounts and with other foods it is very nourishing. But the person who eats a whole bag of candy at one time treats his stomach about as unwisely as if he should drink a whole cupful of thick sugar syrup at once.

Coarse foods necessary to the health. The body needs a considerable quantity of such foods as wheat bread, corn bread, potatoes, cabbages, turnips, and other foods that have large amounts of tough refuse matter in them. These bulky mate-

rials cause the wastes to be more promptly moved along the large intestine. This is very necessary, for if the wastes are allowed to lie in the large intestine bacteria will grow in them and form poisons. These poisons will then soak through the wall of the intestine into the blood, poisoning the whole body

FIG. 19. Outdoor life and exercise are very important in keeping the digestive organs in health.

and causing headaches. Those who live upon the choicest and most expensive foods have health little, if any, better than have those who live on the plainest and simplest fare. Probably the principal reason for this is that those who live on a plain diet get more of the coarser kinds of food and the wastes are more promptly moved along through the intestine.

Alcohol injurious to the digestive organs. Beer, wine, and whiskey contain alcohol, and they

are all injurious to the digestive organs, even when they are taken in small amounts. They injure the stomach especially and interfere with its work, so that hard masses of food pass undigested into the intestine. Bacteria then grow in this food and form poisons that are carried through the body. Alcohol is also the chief cause of diseases of the liver.

Questions: 1. Why is it important to keep the digestive organs in health? 2. By what are digestive troubles usually caused? 3. What must we do in order to get any benefit from the study of rules of hygiene? 4. What effect on digestion has thorough chewing of the food? 5. Why should water be taken at meals? 6. What harm will a glassful of water do if it is all taken at one time? 7. What is the best rule to follow in the use of tea or coffee? 8. Why cannot we eat enough food at one time to supply us all day? 9. Why should every meal be made up of several kinds of food? 10. Why should we eat at regular hours every day? 11. What are some foods that should not be taken for lunch? 12. Of what is candy chiefly made? 13. Why should one eat only a small amount of candy at one time? 14. Why are coarse foods necessary? 15. What effect has alcohol on the digestive organs? 16. What is the best rule to follow in regard to the use of alcoholic drinks?

Suggestions and topics for development: The life and teachings of Horace Fletcher. Healthful school lunches. Necessity for the leisurely eating of school lunches. Soda fountain drinks. Outdoor life and exercise as a preventive of constipation.

CHAPTER NINE

THE CARE OF THE TEETH

THE mouth cavity has been called the Gateway of Life, and the care of the mouth may well be called the Gateway of Health. Horace Fletcher has said that "the whole problem of nutrition is settled in the first three inches of the alimentary canal," and there is far more truth in this than most persons realize. All about us are persons who pay a great deal of attention to the purity of their food. Yet the teeth of many of these persons are so unclean and so decayed that they cannot chew a single bite of food without filling it with millions of bacteria. It is hardly worth while to take care of food for a person who is going to spoil every particle of it before he swallows it, and the health of the nation demands that the people have a better understanding of the importance of the teeth.

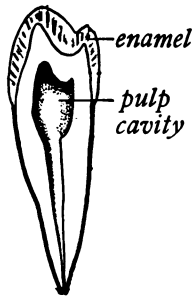


FIG. 20. The structure of a tooth.

The importance of caring for the teeth. In the German army the teeth and toothbrushes of the soldiers are inspected each morning as regularly as the guns are inspected. In the United States army a man is not accepted as a soldier unless his teeth are in good condition. Some German life insurance companies employ dentists to care for the teeth of their policy holders, because they find it is cheaper

to do this than to pay for the sickness and deaths that are caused by bad teeth. Medical inspection of 275,000 school children in New York City showed that more than one half of them had teeth that needed treatment, while dental inspection made of the public school children in Boston and in Cleveland showed that from 95 to 97 per cent of the children had teeth needing attention.

Unclean and decaying teeth a cause of ill health. Unclean teeth and decaying teeth form a breeding place for millions of bacteria of many different kinds. These bacteria become mixed with the food while it is being chewed, and all day they are passing down the throat in streams. In the stomach and intestine they ferment and sour the food, and in this way seriously interfere with the health of the body. Decaying teeth and sore gums also cause people to swallow their food without chewing it properly, and we have already learned how ruinous this is to the health. It is believed also that bad teeth are a cause of adenoids (page 59) and of trouble in the nose.

Unclean teeth and bad teeth a cause of germ diseases. Bad teeth and unclean teeth cause germ diseases in two ways. In the first place, they interfere with the digestion and weaken the body, so that if disease germs get into the body we are not able to resist them. One of the first things to do in the treatment of a consumptive is to get the teeth

in good condition, so that the food will nourish the body and build up the strength. In the second place, unclean and decaying teeth furnish a splendid place for any disease germs that get into the mouth and multiply until a time comes when the body is weak enough for them to attack it. Just how often disease germs do this is not known, but it is known that pneumonia germs are in the mouths of many people; that the diphtheria germ sometimes lives for a long time in the mouths of persons who do not have the disease; that the same germs that cause sore gums, abscesses in the mouth, and decay in the teeth, also cause tonsillitis, sore throat, and appendicitis; that certain other disease germs, including the germ of consumption, have been found in unclean mouths; and that these germs die out more quickly in a clean mouth than in an unclean one. There is, therefore, no reason to doubt that bad teeth are a cause not only of indigestion but of many other forms of disease.

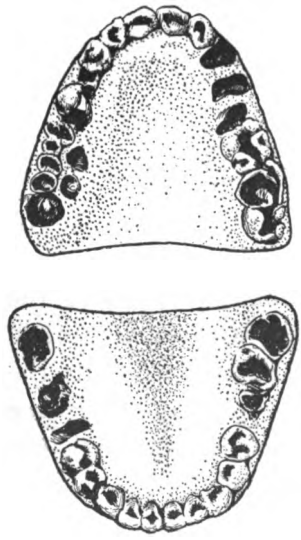


FIG. 21. Teeth like these are a cause of indigestion and furnish a place for the growth of disease germs.

Decay of the teeth caused by failure to keep them clean. Decay of the teeth is caused by bacteria growing in the food materials that stick to the teeth and lodge between them. Clearly, then, the way to keep the teeth from decaying is to keep them clean. They ought to be cleaned every time they are used, just as our dishes are washed every time they are used. To keep them sound they ought at least to be washed after breakfast and before going to bed, while washing the teeth (and the tongue and gums as well) before breakfast saves the digestive organs from the millions of bacteria that have grown in the mouth during the night. In cleaning the teeth, brush them thoroughly both inside and out, and brush them downwards rather than sidewise. A moderately stiff brush should be used, even though the gums bleed, for the gums need the exercise. A tooth powder or tooth paste is a great help in getting the teeth clean. It is very important to remove food from between the teeth, for decay nearly always begins in the places where the food lodges. Sore gums can usually be cured by keeping the teeth clean.

FIG. 22. A number of tooth-brushes in the same holder bring together a choice collection of germs. Each brush should be kept in a separate holder.

Bad teeth a cause of decay in other teeth. As germs from a case of diphtheria may spread through

a whole classroom and cause the disease in every child in the room, so germs may spread from a cavity in a tooth and cause decay in other teeth. We should therefore watch for decayed teeth and have them attended to promptly, because a single neglected tooth may cause the decay of many others.

Visiting the dentist. When a tooth begins to decay, it should be filled by a dentist at once. The sooner this is done the better, for it costs less to fill a small cavity than a large one, it causes less pain, it leaves the tooth in better condition, and it may save the other teeth from decay. A tooth should not be extracted if it can be saved, for the loss of one tooth affects the grinding power of four others. No bridgework or artificial teeth can do the work of the natural teeth in chewing the solid food that we ought to eat. Every one should have his teeth looked over by a dentist once or twice a year, have them cleaned if they need it, and have any small cavities filled. Just as it is better and cheaper to prevent sickness than to try to cure it, so it is better to keep the teeth sound than to try to repair them after they decay, or to replace them after they are gone. "It is better to take pains than to have pains take you."

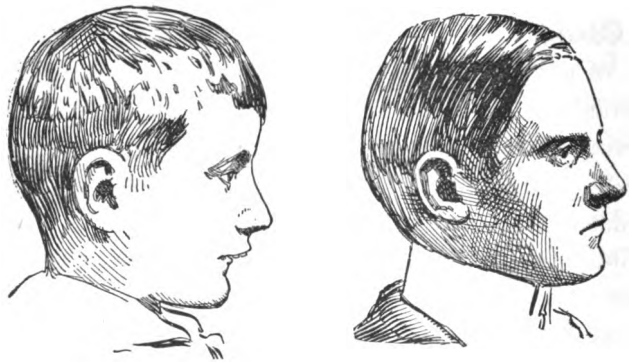
The danger of breaking the enamel. The exposed part of a tooth is covered with a layer of very hard, glistening, white material called *enamel*. This is brittle like glass, and can be easily chipped and

broken. If the enamel of a tooth is once broken off, it is never replaced, and the tooth is likely to decay. Biting on hard objects like nuts, opening a knife blade with the teeth, picking the teeth with a pin or metal toothpick, and similar habits, should be avoided, as they are likely to splinter the enamel.

Caring for the first set of teeth. The first set of teeth need the care of a dentist as much as the second set. Toothache hurts every one alike; swallowing the food without properly chewing it is harmful to young as well as old people, and bacteria from a decayed tooth passing down the throat injure a child as much as they do an older person. If cavities in the teeth of the first set are not filled, the decay may spread to the teeth of the second set as they come in. If the first teeth are pulled, the jaws sometimes fail to grow as they should, and for lack of space the second teeth may come in crowded and uneven. Another important reason for keeping the first set of teeth sound is to prevent the child from forming the habit of swallowing his food unchewed.

Straightening irregular teeth. Because of breathing through the mouth, thumb-sucking, insufficient use in chewing, or for other reasons, the teeth sometimes come in crooked. This not only makes them less useful than they should be in chewing the food, but spoils the appearance of the face. Wonders in straightening the teeth can be done by a dentist who understands this kind of work. Not only can ir-

regular teeth be straightened, but the crowded teeth of a young person can be spread apart, and the bones of the jaw be made to grow until the teeth have room. In this way a weak-looking chin can be made to grow into one that is square and strong.



FIGS. 23 and 24. A boy whose teeth need straightening, and the same boy several years after the straightening was done. Not only were his teeth made more useful, but the lower jaw grew until the appearance of the lower part of the face was changed. Notice how the weak chin developed into one of strength and firmness. (*After photographs in The Popular Science Monthly for July*, 1909.)

The advantage of having good teeth. Good teeth are important from the standpoint of health, but there are still other good reasons why you should keep your teeth white and clean. See how many of these reasons you can give.

Questions: 1. Mention some facts that show how important the teeth are. 2. Tell two ways in which bad teeth injure the health. 3. Give two ways by which bad teeth

cause germ diseases. 4. What causes decay in teeth? 5. How can decay be prevented? 6. How often ought the teeth to be cleaned? 7. Why is it important to remove particles of food from between the teeth? 8. What effect has a decaying tooth on the other teeth? 9. Tell why it is best to visit a dentist occasionally and have the teeth given the care that they need. 10. What is enamel? 11. Mention some ways by which the enamel may be injured. 12. What often happens if the enamel on a tooth is broken? 13. Why should the first set of teeth be cared for by a dentist? 14. What should be done with crowded and uneven teeth?

Suggestions and topics for development: Why a tooth aches. (Illustrate structure by decayed teeth, which may be secured from a dentist.) How to distinguish the first permanent molar from a temporary tooth. What happens to meat or other food matter if it is left in a warm place like the mouth. How the teeth can be kept clean by a child who has no toothbrush. What it would cost to buy toothbrushes for a person for twenty years, and what it costs to have a badly decayed set of teeth repaired.

The first permanent molars, which come in about the sixth or seventh year, are often mistaken for temporary teeth and are allowed to decay. Count the double teeth; when there are three double teeth on one side of the jaw, the back one is a permanent tooth.

Hopkins' *The Care of the Teeth* (published by D. Appleton & Company, New York) is an excellent little book for teachers and parents.

CHAPTER TEN

THE AIR WE BREATHE

CATO, a Roman philosopher, once said that he could kill himself at any time by holding his breath. Cato probably knew more about philosophy than he knew about physiology, for he was not correct in this statement. Try it yourself, and you will find that you can hardly hold your breath for a minute. Spoiled food and unclean water we can refuse, but the air that comes to us we must breathe, whether it be clear or smoky, pure or dust-laden. Nearly a thousand times an hour we take a fresh supply into the lungs. It is clear that no dwelling, schoolhouse, or factory should be built without providing some way of giving the people who must live or work in it a supply of fresh, life-giving air.

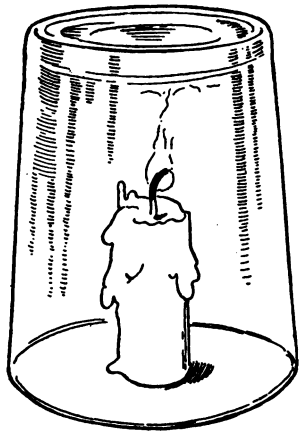


FIG. 25. Experiment showing that a flame cannot burn without oxygen.

Why the body must have air. About one fifth of the air is *oxygen*. Oxygen is constantly used in the body, and without it we cannot live for even five minutes. Set a glass vessel over a burning candle so that no air can get in, and you will see the flame slowly die out for lack of oxygen. So the heat and strength and life of your body will die out if its

supply of oxygen is cut off. *The first reason why the body needs air is to get oxygen.*

All the time we are breathing out from the lungs a gas called *carbon dioxid*. This gas is very poisonous to us. We must keep breathing the air into the lungs in order that, as it passes out again, it may carry the carbon dioxid out of the body; otherwise the body will die. *The second reason why we must have air is to get rid of carbon dioxid.*

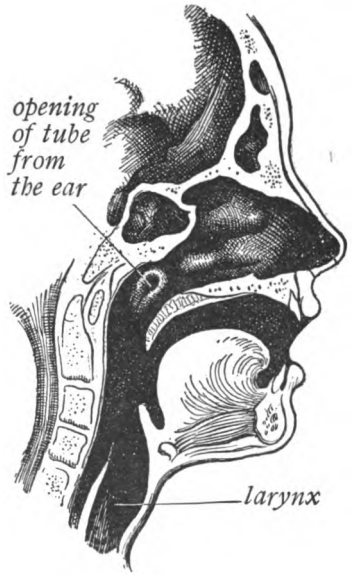


FIG. 26. The air passages of the head and throat.

The necessity for ventilation. Each of us breathes from fifteen to nineteen cubic feet, or from twelve to fifteen bushels, of air every hour. Each cubic foot of air which has passed through the lungs is so impure that it makes nearly 200 cubic feet of air unfit for our use. In houses, which are merely big boxes shut in so that the air inside them cannot mix freely with the air outside, the air is soon unfit for breathing, unless we can get great quantities of fresh air into the houses from the outside. Every

hour about 3000 cubic feet of fresh air are needed by each person in a building, and how to get this air in without causing cold draughts is the problem of ventilation. No one can afford to leave the problem unsolved, for to breathe bad air from day to day causes one to tire easily and to lose strength, to become pale and dull, and, worst of all, gradually to lose the power to resist disease germs.

Crowded buildings often overheated. It is probable that many of the headaches that follow staying in a crowded room are caused by the overheating and the moisture of the atmosphere. At least, it has been found that a crowded room is much more comfortable if it is kept cool. In every such room there should be a thermometer, and the temperature should not be allowed to rise above 68 or 70 degrees.

How to obtain fresh air. Every school building or other building where many people gather together ought to have some system of forcing in fresh air and drawing off the air that has been used. Where this has not been provided for, we must get as much fresh air as possible in some other way. By a little experimenting, it will often be found that certain windows in a room can be opened without causing harmful draughts on any one. Opening several windows a little is usually a good way to ventilate a room. A common method is to set a

board under a window (as shown in Figure 27) while another window on the same side of the room is lowered from the top. Often by lowering all the windows slightly at the top a great deal of the hot, moist air in a crowded room can be got rid of without causing cold draughts. Schoolrooms should be filled with fresh air while they are empty, and at

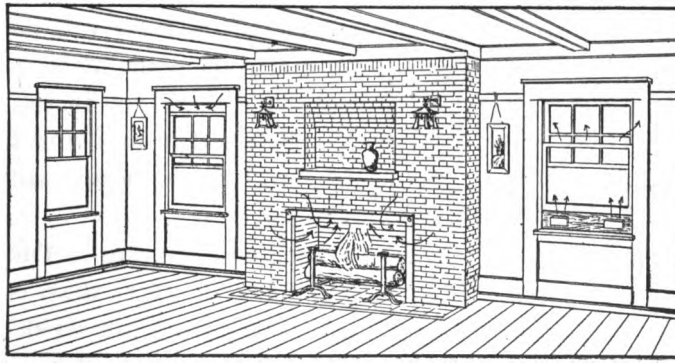


FIG. 27. How a fireplace and a window board help to ventilate a room. The arrows show which way the air is moving.

noons and recesses the windows should be raised and the fresh air allowed to pour in; for no one can be expected either to learn his lessons or to keep his health in a room that is stuffy and close and filled with air that has already been breathed.

Ventilating sleeping rooms. Sleeping rooms are harder to ventilate than living rooms, because we are all the while moving about through our living rooms, and the opening and closing of doors

sets the air in motion. We spend so much of our time in sleeping rooms, however, that it is of the greatest importance that the air in them be pure. Do not sleep in a room where you wake with a stuffy feeling in the morning, but open the windows, or in some other way get fresh air into your bedroom. Do not be afraid of night air, for long ago it was proved to be harmless. A current of fresh air will do no harm if your body is warmly covered, or if you are protected from a direct draught by a window board or a screen.

FIG. 28. The best kind of sleeping room is out-of-doors. This one was planned when the house was built. In summer it is screened to keep out flies and mosquitoes, and in winter it is open on three sides.

Outdoor sleeping. The best place of all to sleep is out in the fresh air, where the impure air that comes from the lungs is blown away so that it cannot be breathed in again. Usually an upper porch is the best place for outdoor sleeping, and houses should be built with porches that can be used for this purpose. In some places these porches need to be screened from flies and mosquitoes. That great benefits come from outdoor sleeping is shown by the fact that persons who are sick with consumption or pneumonia often

improve when they begin sleeping in the open air.

Methods of heating and ventilation. Gas and oil heaters that have no pipes for carrying away the gases give off great volumes of impurities; and to heat a sleeping room with one of these stoves is unhealthful. Stoves and furnaces that leak coal gas also are unhealthful. Fireplaces give good ventilation because they send a current of air up the chimney, and this draws more air into the room. In the same way a stove brings a little air into the room. Radiators bring no new air into a building, and when a system of heating by hot water or steam is used, fresh air should be let into the rooms through windows or ventilators.

Questions: 1. How much of the air is oxygen? 2. Why must the body get rid of carbon dioxid? 3. What are the two reasons why the body must have air? 4. How much air do you breathe in a day? 5. Why must the air of our rooms be constantly changed? 6. How much fresh air does a person need every hour? 7. What are the effects of breathing impure air? 8. What is the most probable cause of the headaches that come from staying in a crowded room? 9. Tell how a schoolroom may be ventilated without causing draughts. 10. What may be done at recess to change the air in a room? 11. Why is it hard to ventilate sleeping rooms? 12. Why is it important that they be well ventilated? 13. What is the best of all sleeping places? 14. How is this proved? 15. What methods of heating bring fresh air into a house?

CHAPTER ELEVEN

THE LUNGS AND AIR PASSAGES AND THEIR CARE

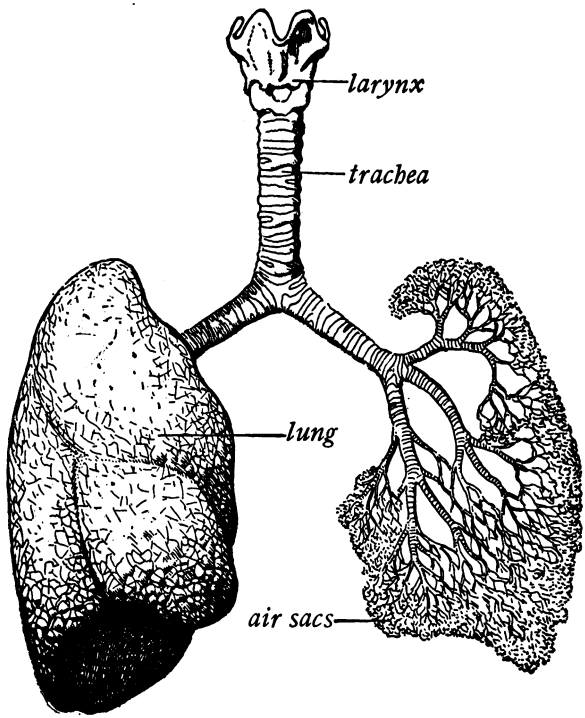


FIG. 29. The lungs.

OF all the organs of the body, the lungs and air passages are most frequently attacked by disease germs. Colds, catarrh, bronchitis, and grip are so common that no one entirely escapes them, while pneumonia and consumption kill thousands of persons every year. Yet every person can do much to avoid these diseases by taking a reasonable amount

of care of his breathing organs and by securing for himself an abundance of fresh air. We have learned some ways by which we may secure pure air; now we are going to learn how to care for the organs that get rid of carbon dioxid and take in oxygen for the body.

The air passages. The air enters the nose through the nostrils and passes down into the throat through two openings at the back of the mouth. It then goes down the windpipe (trachea), which divides and enters the two lungs. These large branches of the trachea divide into smaller and smaller branches, as a tree divides into small limbs and twigs, and these smallest branches end in little air sacs. The lungs are mainly composed of millions of these little tubes and the air sacs at their ends. The air which we breathe passes down the windpipe and out through the tubes into every one of these sacs.

The blood purified in the lungs. In the thin, delicate walls of the air sacs of the lungs are great numbers of very small blood vessels. As the blood passes through these vessels in fine little streams, it takes up oxygen from the air in the sacs and gives off carbon dioxid. The carbon dioxid is then breathed out of the body, and when the next breath is taken in, more oxygen is drawn down into the lungs.

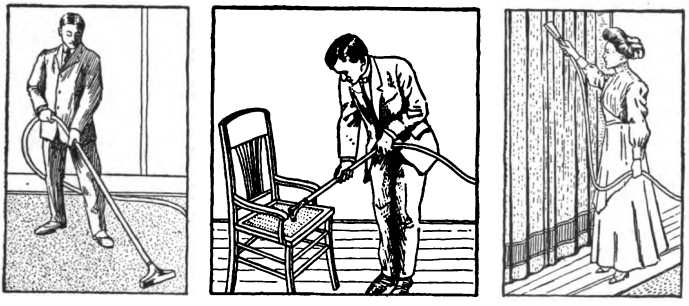
The danger of breathing dust. Most of the diseases of the air passages and lungs are germ

diseases. Dust causes these diseases by carrying germs into the air passages, and also by wounding the walls of the air passages so that germs already in them may get a chance to start growing. More than one fourth of all the deaths among the cotton-mill workers in Rhode Island from 1897 to 1903 were caused by consumption; and in some trades, like metal grinding and stone cutting, more than one half of the workers die of diseases of the lungs. Facts like these show how great is the danger of breathing dust, and how much care should be taken to keep it from getting into the air that we breathe.

FIG. 30. Dust should be wiped from furniture, and should not be stirred up into the air.

Keeping down dust. The streets of cities and towns should be kept sprinkled, and where it is possible to do so, they should be cleaned by flushing them with water instead of by sweeping them. Sweeping both in schoolrooms and in private houses ought to be done with the windows open and in a way to stir up as little dust as possible. The best way of all to do this is with a vacuum cleaner, which makes it possible to get rid of the dust more

completely than in any other way. Dust on furniture should not be stirred up into the air, but should be wiped off with a damp cloth (a piece of flannel soaked in paraffin oil is best for this purpose). Everything possible should be done to keep down dust, for where



FIGS. 31, 32, and 33. The best way to free a house from dust is with a vacuum cleaner.

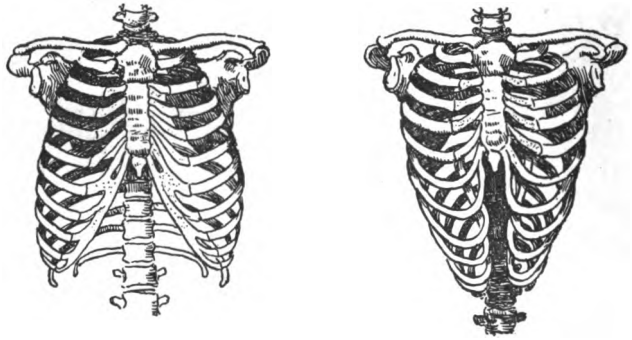
people are forced to breathe it, great numbers of them die from diseases of the air passages and lungs.

The harmfulness of crowding the lungs. When a person sits at his desk with his shoulders bent over, the muscles are not able to pull the ribs up in breathing, as they could do if he were sitting erect. Also, the stomach and liver push up and crowd the lungs from below. This causes the lungs to be only partly filled with fresh air.

The lungs can also be crowded by tight clothing about the chest, which keeps the ribs from moving freely; or by tight belts or other tight clothing about the waist, which force the liver and stomach

upward and hinder the movements of the lungs. Great harm can be done to the lungs by crowding them in either of these ways. In another chapter (page 81) we shall discuss the best way of keeping the body erect.

The effect of tobacco smoke on the air passages and lungs. Tobacco smoke causes the lining



FIGS. 34 and 35. The figure on the left shows the natural position of the bones of the trunk. The figure on the right shows how the ribs may be pressed in by tight clothing; the heart, lungs, and digestive organs are then cramped and injured.

of the air passages to become inflamed, and a considerable number of smokers have "smoker's sore throat." The worst effect of tobacco, however, comes from taking the smoke into the lungs, as cigarette smokers almost always do. This is especially injurious to the body, because large amounts of the poisonous matter in the tobacco smoke pass through the thin walls of the air sacs into the blood

and are carried all through the body. Smoking also causes a shortness of breath, as the cigarette smoker who tries to win a race very well knows.

The effect of alcohol on the lungs. The chief injury to the lungs and air passages caused by alcohol is that it makes them more easily attacked by germ diseases. It has long been known by physicians that pneumonia is much more likely to kill a user of alcohol than a temperate person, and that drinkers suffer far more from consumption than do persons who use no alcohol. Were there no reason but this for not using alcohol, any one would be foolish to drink it; for pneumonia and consumption are so common that in the part of the United States where a record is kept of deaths, one person in five dies from one or the other of these diseases.

Breathing exercises. You should stand erect several times a day and take a few long, deep breaths. If you have been sitting quietly at your work for some time, it will make your tired muscles more comfortable to stretch the arms and swing them about. A half-dozen breaths of cool, fresh air, taken at an open window, will do wonders toward waking you up when you have become tired and sleepy at your work. It is good for the whole body to have the carbon dioxid emptied out of the lungs, a fresh supply of oxygen taken in, and the heart made to send the blood more quickly on its way. Vigorous breathing exercises should not be practiced

by persons who are sick or weak, however; and they are very injurious to consumptives. No one should practice breathing exercises long enough to make himself dizzy.

Questions: 1. What are some of the most common diseases of the organs of breathing? 2. How can we, to some extent at least, avoid these diseases? 3. How does air get into the trachea? 4. Of what are the lungs principally made up? 5. How does the air get into the air sacs? 6. How does oxygen get into the blood? 7. What is given off in exchange for oxygen? 8. In what two ways may dust cause injury to the air passages and lungs? 9. Name some dusty trades, and tell how you know that it is dangerous to breathe dust. 10. What is the best way to clean the streets of a town or city? 11. How should a room be swept? 12. What are the effects upon the lungs of a stooping position? 13. Why is this injurious? 14. How should clothing and belts be made to fit? 15. What is the chief harm done to the organs of breathing by alcohol? 16. What proportion of all deaths is caused by pneumonia and consumption? 17. State three ways in which the habit of smoking is injurious. 18. What are the advantages of breathing exercises? 19. What persons should not take them?

Suggestions and topics for development: Plain furniture and floors finished for use with rugs compared from a hygienic point of view with carpeted floors and plush-covered furniture. The cost of laying a hardwood floor over another floor compared with the cost of an equal area of carpet. How your schoolroom can be swept without raising dust.

CHAPTER TWELVE

ADENOIDS AND ENLARGED TONSILS

FIG. 36. Children with adenoids. Many children who have adenoids breathe through the mouth only at night or when they have a cold.

THERE are certain troubles of the nose and throat which do not often cause either sickness or pain, but which narrow or close the air passages and keep the person from getting a sufficient supply of air. These diseases often go on for years without being discovered, but they are serious and should be promptly treated when found. How common these troubles are is shown by the fact that in 415 villages of New York State it was found that nearly one eighth of the school children were breathing through the mouth instead of the nose.

The evil effect of breathing through the mouth. Mouth breathing causes the upper teeth to turn forward and the lips to thicken and turn out, thus spoiling the appearance of the face. What is more serious, it allows millions of bacteria to get

into the mouth, and it allows cold and dusty air to reach the throat and lungs. Worst of all, the general health of the mouth breather is weakened.

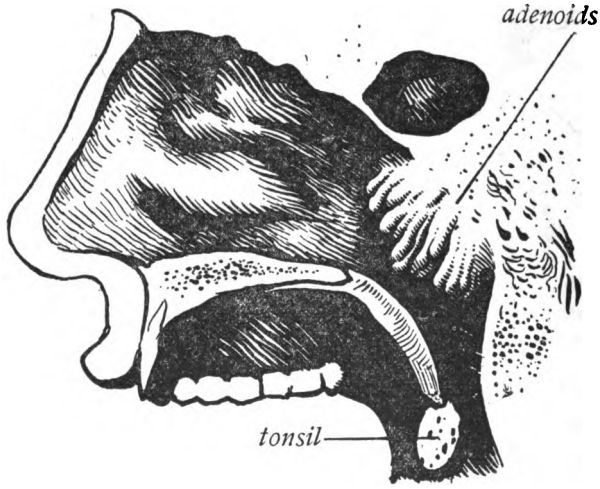


FIG. 37. Adenoids grow high in the throat and block the openings from the nose into the throat.

The cause of mouth breathing is usually adenoid growths or enlarged tonsils.

Adenoids. Examinations have shown that in moist climates as many as one sixth of all the children of school age may have adenoids. They are soft, spongy bodies that grow high up in the throat where the passages from the nose open at the back into the throat (Fig. 37). They partly or entirely stop up the nose so that the person must breathe through the mouth, and they are often the cause of deafness. The usual symptoms of adenoids

are breathing through the mouth, a narrow upper jaw and crowded teeth, thick lips and a running nose, difficulty in talking, inflamed eyes, and deafness. In most cases the inner corners of the eyes are drawn down, and the face has the strained expression that you see on the faces of the children in Figure 36. Many children who have adenoid growths are smaller than they ought to be, some of them have difficulty in keeping up with their classes, and sometimes adenoids have the strange effect of causing the child to be restless, idle, stupid, quarrelsome, and a general mischief-maker.

Enlarged tonsils. The tonsils are located one on each side of the throat. Sometimes they become swollen and close the openings that lead down from the back of the nose into the throat. This condition is so common that when 275,000 children in the New York City schools were examined, more than one fourth of them were found to have enlarged tonsils. Such a condition of the tonsils causes mouth breathing and the germs from them are a continual danger to the voice, the lungs, and the digestive organs.

The importance of treating adenoids and enlarged tonsils. Does your nose become stopped up whenever you take a little cold? Do the other members of your family tell you that you sleep with your mouth open and that you snore in your sleep? Is it hard for you to keep your nose clean? Do you

talk through your nose? Are you troubled with earache or deafness? Do you suffer from tonsillitis, or do you have any other of the symptoms of adenoids?

If you are troubled in any of these ways, ask your parents to take you to a physician, who, by a very small operation, can remove the cause of your troubles. Do not allow any one to persuade you to wait until you outgrow adenoids; for while you may outgrow the adenoids themselves, the ugly shape of the mouth and lips, the narrow air passages in the nose, and the deafness that the adenoids cause will remain through life. Besides, you can no more get fresh air through a closed nose than through a closed window, and it is almost as hard to grow into a strong, healthy man or woman while you are struggling for air as it would be to do so without sufficient food.

Questions: 1. How does mouth breathing change the shape of the mouth? 2. What are the worst effects of mouth breathing? 3. To what is mouth breathing usually due? 4. What are adenoids and where do they grow? 5. What are some of the results of adenoids? 6. Where are the tonsils? 7. What are some of the results of enlarged tonsils? 8. Why should adenoids or enlarged tonsils be removed as soon as they are found? 9. Is it reasonable to wait to outgrow such troubles?

Suggestions and topics for development: Watch pupils for symptoms of adenoids and enlarged tonsils. A number will be found with these troubles if the teacher will learn to recognize the symptoms.

CHAPTER THIRTEEN

THE BLOOD AND THE HEART

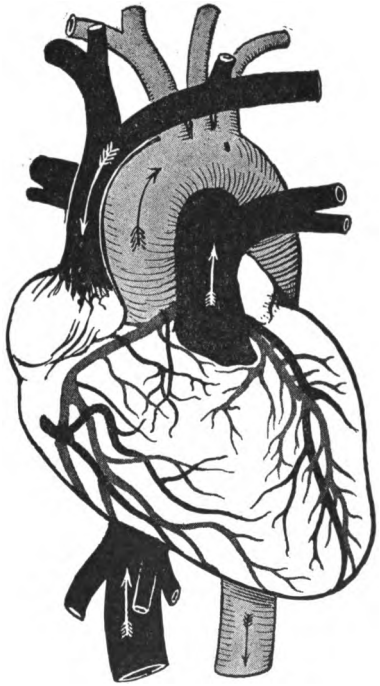


FIG. 38. The heart.

SUPPOSE that in a great city all the wagons that deliver groceries and milk, and all the carts that haul away rubbish and garbage, should stop running. The grocery stores might have abundant supplies of food, but the food could not be taken to those who needed it, and there would be suffering and starvation throughout the city. The garbage cans would become filled to overflowing, and so much waste

matter would collect that disease and death would be caused by it. The very life of the city depends on having some way of carrying food to every part of it and some way of taking away the wastes.

Your body is much like a city. Every part of it must have food and oxygen brought to it, and every part must have its wastes carried away, or it cannot live. We are now to study how this work is done.

The blood. The blood carries everything that is to be moved from one part of the body to another. It takes up the food which soaks through the wall of the intestine and the oxygen that comes in from the lungs. It carries these all through the body, and supplies them to the muscles and the brain and the other body parts. It also takes up the wastes of all the organs and brings them to the lungs and kidneys, where they are thrown out of the body. To do this work, the blood must travel swiftly through the body night and day as long as the body is alive.

The heart. Place your hand on the left side of your chest and you can feel your heart beat. Count how often it beats in a minute. As the heart beats it pumps the blood through the body. Day after day and year after year it must work to keep the blood flowing through the body.

The blood vessels. The blood vessels are hollow tubes or pipes. There are two great sets of them connected with the heart and running everywhere

through the body. One set is called the *arteries*. They carry the blood out *from the heart* to every part of the body. The other set of blood vessels is called the *veins*. It is their work to collect the blood from all parts of the body and bring it *back to the*

FIG. 39. Long races, where the runners suffer from exhaustion and collapse, are too severe for boys. (*After McKenzie.*)

heart. Near the heart the blood vessels are very large, but through all the body there are thousands of little blood vessels, so small and so close together that you cannot run the point of the finest needle into your flesh without breaking many of them.

Violent exercise injurious to the heart. Run up and down stairs two or three times, or run a hundred yards as fast as you can. Then notice your heart and you will find that it is beating much harder and perhaps twice as fast as it beats when you are sitting quietly in your seat. From this you

can imagine how enormously the work of the heart is increased in Marathon races, hard bicycle riding, football, rapid and long-continued skipping of the rope, or hour after hour of tennis playing. When the heart is overworked, it often becomes enlarged and diseased, and this condition is found so often among those who engage in hard games and sports that it is called "athlete's heart." Young persons are especially liable to have their hearts injured by very severe games and long races. They should therefore take their exercise in a way that will not put too great a strain on the heart.

The effect of alcohol on the heart. Alcohol often causes the heart to become weakened; and in drinkers, especially beer drinkers, great quantities of fat sometimes gather about the heart. In this condition the heart cannot do its work properly; and in sicknesses like typhoid fever or pneumonia, it is likely to fail. Alcohol often causes the walls of the blood vessels to become hard and brittle. Strokes of paralysis and apoplexy (which are caused by the bursting of a blood vessel in the brain) are far more common among drinkers than among those who do not use alcohol.

How to stop bleeding from a wound. If the blood flows from a wound in spurts, the cut blood vessel is an artery. The bleeding can be stopped by twisting a cord or a knotted handkerchief above the wound, as shown in Figure 40. If the blood

flows in a steady stream, the cut vessel is a vein; in this case the bandage should be placed below the wound. The injured part of the body should be kept raised. If the cut vessel is a large one, it is necessary to act very quickly, and some one should press on the part to stop the bleeding until the bandage can be made ready. If the wound is on the head or body, a thick cloth should be pressed firmly down upon it. A physician should be called as quickly as possible.

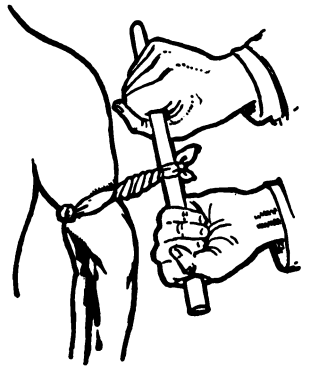


FIG. 40. Checking bleeding from a wound.

Bleeding from the nose. Bleeding from the nose may often be stopped by simply pressing the upper lip against the teeth, or against a small ball of paper or some other object placed between the teeth and the lip. Bathing the neck in cold water may also help to check the bleeding. The head should be held erect in nose bleeding, so that as little blood as possible will run to the nose. Do not blow the nose, for this will often start the bleeding afresh.

Questions: 1. In what ways is the body like a city? 2. What does the blood do in the body? 3. Where is the heart? 4. How often does your heart beat in a minute?

5. Why does the body live only so long as the heart beats? 6. What are the two sets of blood vessels called? 7. What do the arteries do? 8. What do the veins do? 9. What effect has exercise upon the heart? 10. Name some forms of exercise that put a great strain on the heart. 11. What effect has alcohol on the heart? 12. On the blood vessels? 13. Tell how to stop bleeding from a cut in the arm or leg. 14. From a cut in the body or head. 15. From the nose.

CHAPTER FOURTEEN

THE KIDNEYS

EXAMINE the body of one of the animals that hang in a meat market and you will find two dark red organs fastened to the back wall of the body. They are bean-shaped, and lie half buried in fat, one on each side of the backbone.

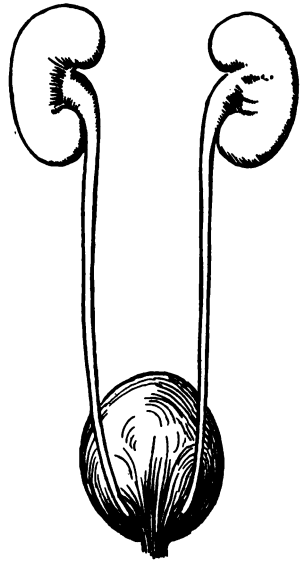


FIG. 41. The kidneys and the bladder.

What are these organs? They are the kidneys. What do they do? They take wastes out of the blood. Is their work important? Their work is as important as the work of any other organ of the body, for if they fail to do it the wastes will poison the body and cause death. We could no more get along without kidneys than we could get along without our digestive organs or our lungs.

How the kidneys remove the body wastes. A large blood vessel passes into each kidney and sends branches into every part of it. As the blood passes through the kidneys, the kidneys purify it by taking the wastes out of it, just as the lungs purify the blood by taking the carbon dioxid out of it. The wastes from the

kidneys are carried to the bladder by a duct from each kidney.

Keeping the kidneys in health. The kidneys lie deep in the body, and we can best keep them in health by caring for the whole body. There are, however, some things that should be avoided if possible. Among the things that are especially likely to injure the kidneys may be mentioned heavy lifting, exposure to cold and wet, indigestion, eating too much meat, and especially the drinking of alcohol, which is by far the most common cause of kidney trouble.

Questions: 1. Where are the kidneys found in the body? 2. What is their function? 3. Name some things that injure the kidneys. 4. What effect have alcoholic drinks on the kidneys?

CHAPTER FIFTEEN

THE SKIN

FIG. 42. Swimming is an invigorating way to take a bath. It is also one of the best forms of exercise, because it brings into play all the muscles of the body. (*After Sorolla's "The Swimmers," in the Metropolitan Museum of Art.*)

THE living parts of the body are extremely delicate and tender, and if they were exposed to hurts, to drying, and to disease germs they could not live. We therefore have over the whole body a tough coat which protects the delicate living body parts. The inner part of this coat is alive, but the part which comes in contact with the outside world is dead and keeps falling away in dry scales.

The structure of the skin. The skin is composed of an outer layer called the *epidermis* and an inner layer called the *dermis*. The epidermis has no

blood vessels in it, but its inner part is alive and keeps growing to take the place of the outer part that is all the time dying and falling away. Everywhere in the skin are little sweat glands that pour out the sweat on the surface of the skin.

The skin a regulator of the body heat. The temperature of the healthy body, winter and summer, is about 98.6 degrees. It remains the same because the skin regulates the heat of the body. This it does in two ways. When we are hot, the blood vessels in the skin open up and allow the blood to come to the outside of the body, where it can be cooled. When we are cold, the vessels in the skin close up and keep the blood in the warm inner parts of the body. Another way in which the skin regulates the heat is through the sweat glands. These assist in cooling the body by pouring out water on the skin. If the sweat glands fail to work, the temperature of the body goes too high and we have fever.

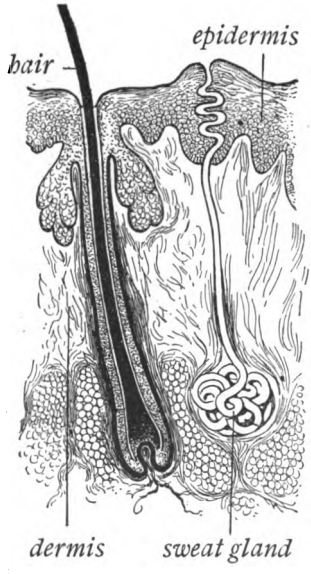


FIG. 43. A section of the skin, highly magnified.

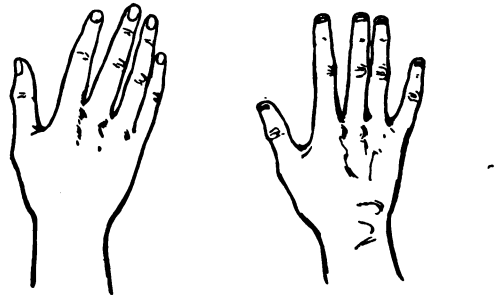
Wet the hand and hold it up to the wind. Do you feel your hand being cooled as the water evaporates from it? Or pour alcohol or gasoline over the hand and allow it to dry off. Do you feel that your hand is being cooled? Suppose the air was so moist that the sweat could not evaporate from the skin. Would it cool the body to have the skin wet with sweat? On what kind of day do we suffer most from heat?

The hair. The hair grows from the epidermis, and like the outer layer of the epidermis the hair is dead. It contains no blood vessels, and there is no sense of feeling in it. The growth of the hair is at the root. The hair is composed of the same material as the outer layer of the skin.

Each hair stands in a little pocket of the epidermis that is folded down deep into the dermis. Opening into this small pocket are little glands that pour out oil around the root of the hair. Brush your hair thoroughly and it will become smooth and glossy from the oil that you work out from around the roots. Fine hairs are found all over the body, and the oil that comes from the glands at the roots of these hairs keeps the skin from becoming dry.

The care of the hair. In the care of the hair nothing is so important as thoroughly brushing it. This brings the blood into the scalp and spreads the oil along the hair. The hair should not be wet

every time it is combed, for the oil will be washed off, making the hair too dry. The head should be washed occasionally with good soap to cleanse the hair and remove scales and dirt from the scalp. Dandruff is caused by germs growing in the oil glands and in the little pockets about the hairs. One person can get this disease from another, and



FIGS. 44 and 45. Well kept finger nails and finger nails that have been bitten off.

for this reason public combs and brushes should not be used.

The nails and their care. A nail is a portion of the outer layer of the epidermis that is very much thickened and hardened. Its growth is at the base. When a nail is lost a new one will grow in its place if the bed on which the nail rests is not destroyed; but if this bed has been destroyed, the nail will not grow again.

The nails should not be bitten off, nor should they be trimmed "to the quick," for this will spoil their

shape and their appearance. They should be allowed to grow long enough to protect the ends of the fingers, and the space beneath the ends of the nails should be kept free from dirt. This is more

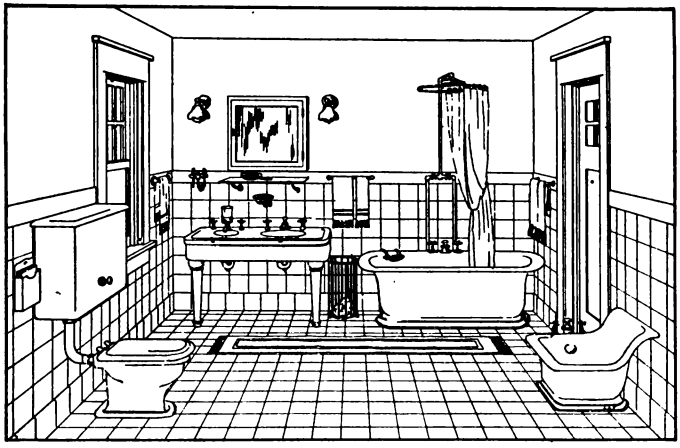


FIG. 46. Showing the necessary sanitary fixtures of a modern bathroom. Note especially the tooth basin, the use of which keeps germs from the mouth from getting into the wash basin.

a question of common cleanliness than it is of health; although it is a fact that bacteria multiply in the dirt under the finger nails, and inflammation sometimes is started in the skin by scratching with dirty finger nails.

Bathing. "Tolerate no uncleanness in your body, clothes, or habitation" was one of Benjamin Franklin's rules for success, and few men have understood the secrets of success better than he. Finger nails that are in mourning, greasy hair, soiled

and unbrushed clothing, unclean teeth, and the lack of a needed bath cause a person to be disagreeable to those about him. Such conditions greatly hinder usefulness and success.

Cold baths. Those who take a daily cold bath do not catch cold so easily as do others, and many strong, vigorous persons are greatly benefited by this practice. Weak and sick people, however, and especially those who are inclined to be nervous, should not take cold baths except upon the advice of a physician. The safest rule to follow in bathing is to use lukewarm water unless you can take a cold bath with pleasant results.

Questions: 1. What use has the skin? 2. Name the layers of the skin. 3. What do the sweat glands do? 4. What is the temperature of the healthy body? 5. Explain the two ways of regulating the heat of the body. 6. In what does a hair stand? 7. Where does the oil for the hair come from? 8. Does a bird have oil for its feathers? 9. Explain how brushing benefits the hair. 10. What is the cause of dandruff? 11. How can a person catch dandruff? 12. Why is it important to keep the nails clean? 13. What was Benjamin Franklin's rule of success regarding cleanliness? 14. What advantage is there in taking cold baths? 15. What persons need to be careful in taking cold baths?

CHAPTER SIXTEEN

CLOTHING

FIGS. 47 and 48. A so-called parlor slipper and one kind of Chinese shoe. Is either of them a sensible shoe?

CLOTHING protects the body from injury and shields it from heat and cold and from sun and rain. Our personal appearance depends to a great extent on the clothing that we wear, and it is right that we should try to have our clothing as neat and as becoming to us as is possible. We should not forget, however, that the real use of clothing is to protect the body; that if we wear clothes that are uncomfortable and unsuited to the weather merely because they are pretty, we are as foolish as we should be if we tried to live on peaches because they are more beautiful than bread and meat.

Clothing in cold weather. Clothing protects us from cold by keeping the heat of the body from passing off into the air. Only enough clothing should be worn to keep the body warm, because heavy clothing overheats the body and interferes with the breathing and the movement of the blood.

Overcoats and wraps should be worn in cold weather, but they should be taken off when we come indoors. If this is not done, the body will become too hot, the blood will come out into the skin, and the sweat glands will begin working. Then, on going out into the cold, the body is too suddenly cooled and there is danger of taking cold.

Wet clothing and wet feet. Wet clothing takes the heat out of the body, and we should not allow the body to be chilled by letting clothing dry on it. Since cold and wet feet very commonly bring on colds, wet shoes and stockings should be changed for dry ones as quickly as possible.

Three habits that will be of great value in saving you from colds and other diseases of the air passages and lungs are wearing overshoes when your feet will become damp without them, carrying an umbrella when there is danger of rain, and wearing an overcoat or wrap when you need it.

Changing clothing with the changes of the weather. The Chinese seem to us to be a strange people, but when we examine into their customs we find that there is often much common-sense in the Chinese way of doing things. These shrewd people speak of the weather as one shirt weather, two shirt weather, three shirt weather, or four or five shirt weather, according as the weather is hot or cold. This means that on a hot day a Chinaman puts on one thin shirt, and the cooler the weather the more shirts he puts on.

We can learn a great deal from the Chinese about wearing clothing that is suited to the weather. An extra undershirt on cool days in the spring and fall and on very cold winter days would save many of us from colds or more serious sickness. Wearing cool, sensible clothing in the summer, instead of heavy woolen garments, would prevent much of the suffering and sickness and many of the prostrations that come from the heat.

FIGS. 49 and 50. What trouble will the shoe at the right cause?

A little baby should be thinly dressed on a hot day and warmly dressed in cold weather, and its clothing should have especial attention during changeable weather and on cool nights. Trying to harden children by having them go barefooted or with little clothing in cold weather is a mistake.

Questions: 1. What are the uses of clothing? 2. When should overcoats and wraps be worn? 3. Why should they be removed when we are indoors? 4. Why is wet clothing injurious to the body? 5. Mention three habits that would help to save us from colds and other sickness. 6. How do the Chinese describe the weather? 7. What may we learn from the Chinese about properly clothing ourselves?

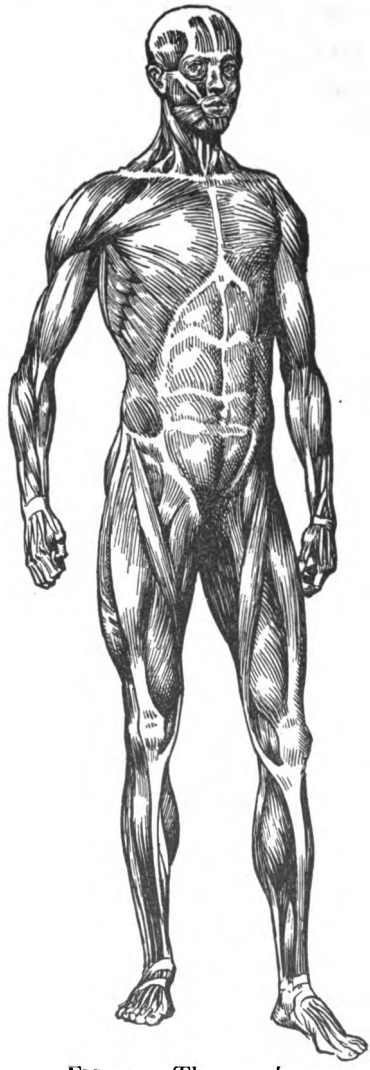
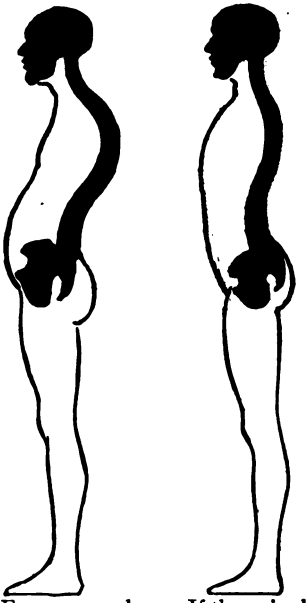


FIG. 51. The muscles.

CHAPTER SEVENTEEN

THE CARRIAGE OF THE BODY

"STAND up and be a man!" A wise old teacher often said this to the boys of his school. It is good advice, for an erect carriage of the body does much to make and keep one strong. It gives the heart and the lungs room to do their work, and it allows the life-giving blood to flow freely through all the body. No one who allows himself to stoop so that his lungs and heart are crowded together can be strong. One should "stand up and be a man" if he wishes to have a healthy body.



FIGS. 52 and 53. If the spinal column is allowed to droop the body is stooped. If the spinal column is straightened out the body is held erect. (*After McKenzie.*)

The skeleton. The skeleton forms the framework of the body. The backbone, or spinal column, runs up the back and carries the head on its top. From the spinal column the ribs and the shoulders are hung. The weight of all the upper part of the body falls on the spinal column, and if this part of the skeleton bends, the whole body will be stooped.

The muscles. The muscles are stretched on the framework of the body. *Their work is to move the body.* Lay your hand on your arm above the elbow and bend the arm. You feel a muscle drawing itself together to pull up your forearm. Put your hand to your cheek while you close your teeth, and you feel the movements of the muscle that closes the jaws. All over the body we have masses of strong muscles that slide smoothly and noiselessly over each other and move the different parts of the body.

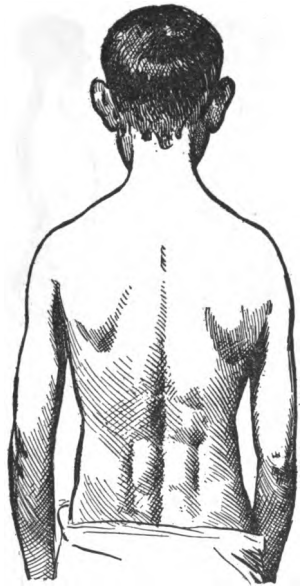
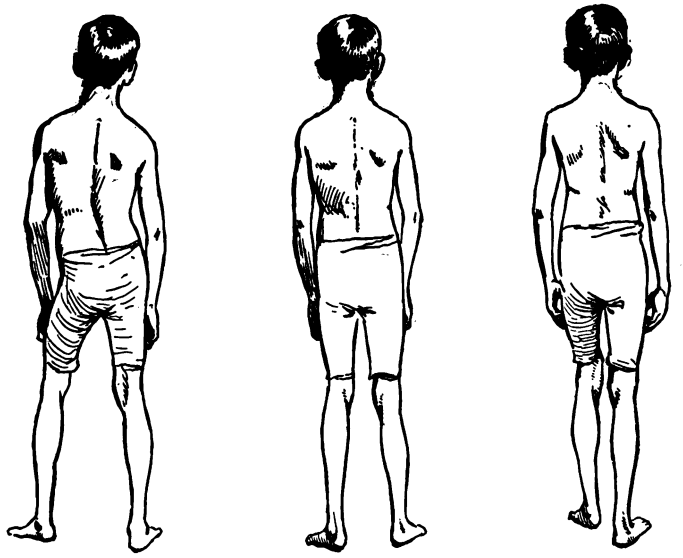


FIG. 54. Point out the muscles that support the spinal column.

How the body is held erect by the muscles of the spinal column. The body is held erect by great muscles that lie along the back on each side of the spinal column. The spinal column is held up if these muscles do their work properly, but if they are weak the spinal column bends forward, the head droops, and the ribs drop down and crowd the heart and lungs. No one can straighten himself by pushing his shoulders back, for the shoulders are supported by the

spinal column just as the ears are supported by the head. *The body can be straightened only by*



FIGS. 55, 56, and 57. Standing in the first position and throwing all the weight of the body on one leg twists the spinal column. Standing with the feet even, or with one foot only slightly in advance of the other, keeps the spinal column straight. (*After Mosher.*)

tightening up the muscles along the back and straightening the spinal column.

How to secure a correct carriage of the body. Stand and walk with the top of your head pushed up as high as possible. This straightens out the spinal column. Pull your chin in and push the back of your neck against your collar. Draw in your abdomen and do not allow your back to

bend forward at the waist. Exercise helps to develop the muscles that hold up the body, but no amount of exercise can give one an erect carriage. The best way to straighten up is to do it.

The importance of holding the body erect in youth. The bones of a little child are easily bent, and by beginning in time they may be made to take almost any form, without causing much pain to the child. As a person grows older, the bones harden, and it is then impossible to change their shape. If you want to have a straight, beautiful body, you cannot put off beginning to hold yourself erect. The grown man or woman whose bones have hardened in a stooped position can never straighten up, but must go through life with cramped heart and lungs. "Stand up and be a man!"

Questions: 1. How does an erect carriage help the body organs to do their work? 2. What is the function of the spinal column? 3. What is the work of the muscles? 4. How is the body held erect? 5. State three things that must be done in order to have a correct carriage. 6. Why is it important that children learn to carry the body properly?

Suggestions and topics for development: Watch the pupils for faulty postures and privately advise with them as to the best methods of correction. Pay special attention to the curve of the spinal column and the relative height of the shoulders. See that each pupil has a seat and a desk of the proper height, providing footrests for the smallest children if necessary. Have the pupils trace the curve of the spinal column in Figure 59. Show how sitting in this position will cause the head to be thrust forward when standing and walking.

FIG. 58

FIG. 59.

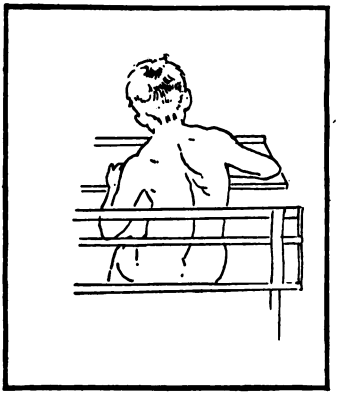


FIG. 60.

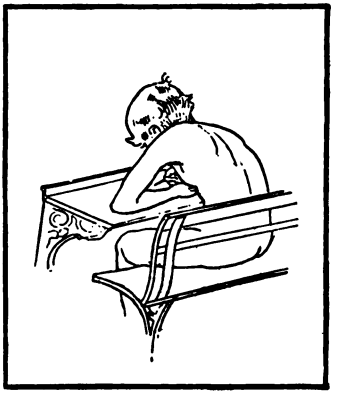


FIG. 61.

In Figure 58 the seat and desk are of such a height that the feet rest squarely on the floor, the body is held easily erect, and the shoulders are even. In Figure 59 the desk is too high and too far away from the seat. In Figure 60 the desk is too high, causing lateral curvature of the spine and uneven height of the shoulders. Figure 61 shows the bending over caused by too low a desk. (*After Shaw.*)

CHAPTER EIGHTEEN

EXERCISE

FIG. 62. Outdoor games furnish the best exercise because they bring into use all the muscles of the body, they take the mind off its tasks, and they keep us out in the fresh air.

EXERCISE makes the muscles strong, it quickens the flow of the blood, it improves the digestion, and it builds up the general health. Like food, it is good for us and ought to be taken every day. Yet, as we can injure ourselves by eating more food than we can digest, so we can injure the body by taking too much or too violent exercise or by taking it at the wrong time. In this chapter we shall study how to take exercise so that we shall get the most good from it.

The open air the best place to exercise. The best place to exercise is in the open air. Then we get not only the benefits that come from the exercise but also the benefits that come from staying in the open air. In cities this is an especially im-

portant point, and many cities are now providing open-air playgrounds for the children of their crowded sections. If you live near such a playground, go to it as often as you can and take your little brothers and sisters with you, for outdoor play makes strong muscles, healthy lungs, rich blood, and an active brain.

Exercise and the digestion. Nearly everybody who neglects to take exercise suffers from indigestion. You might as well understand this, for if you become too lazy or careless to exercise your muscles you can look forward to trouble with your stomach. On the other hand, you ought not to exercise hard immediately before eating, and you should rest a while after eating, or the digestive organs will not get the blood they ought to have while they are forming the digestive juices. When a boy is hot and tired, his blood is in the skin, and when he is running and playing, it goes to his muscles and not to the organs that are digesting the food.

Some rules in regard to exercise. *Exercise ought to be taken regularly.* A reasonable amount every day is far better than a large amount one day and none the next. *Proper exercise brings into use and builds up all the muscles.* It does not make giants of a few muscles and leave the others small and weak. Outdoor games are best of all for developing the whole body. *One should not allow*

himself to cool off too quickly after exercising, as there is then danger of taking cold. Do not sit down without a coat or wrap when you are hot and tired, but walk about until you have become cool.

Over-exercising. In a former chapter (page 65) we have spoken of the danger of injuring the heart by too violent and long-continued exercise.

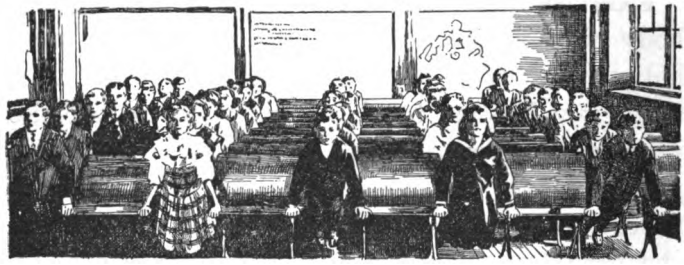


FIG. 63. Children exercising in a schoolroom. Even in a crowded room, and without any apparatus, very beneficial exercises can be given. (*After McKenzie.*)

Such exercise is not good for any part of the body. Do not play tennis all day. Do not run after and kick a football all afternoon. Do not ride a bicycle too hard. Do not play baseball or exercise in a gymnasium until you are so tired that you still feel it the next morning. Be moderate and sensible in your exercise as in everything else, and remember that if you exercise until you are so exhausted that you cannot quickly rest afterwards you have gone too far.

Exercise in the schoolroom. After one has been sitting quietly at a desk for an hour or two,

the breathing is shallow, the muscles are tired from remaining a long time in one position, the heart-beat is slow, and the brain is beginning to tire. A person in this condition feels sleepy and dull, and he can learn little by sitting and looking at his book. If, however, he will stand up and spend a few minutes in stretching and breathing exercises, he will find himself feeling much better. The breathing will become deeper, the heart will beat more rapidly and with more force, and the tired muscles will feel rested. The brain and the body are "waked up," and the person can go back to work, feeling greatly freshened and rested. Several times a day every one in a schoolroom should spend a little time in such exercises as are described in Chapter Twenty-seven. While this is being done, all the windows should be thrown wide open and the fresh outside air allowed to fill the room.

Questions: 1. What are some of the benefits of exercising? 2. What is the best place to take exercise? 3. Why should those who live in cities make use of the parks and open-air playgrounds? 4. Why is it unwise to exercise immediately before or after a meal? 5. Give three good rules in regard to exercise. 6. In what games or sports do the players sometimes injure themselves by too much exercise? 7. What is the best way to rest after you have become tired of study?

Suggestions and topics for development: The exercise that pupils take during play hours. The wisdom of supplying school and municipal playgrounds.

CHAPTER NINETEEN

THE NERVOUS SYSTEM

If an army had no officers, and each soldier marched as he pleased and camped where he pleased, we should not call it an army at all, but a mob; and if the whole army attacked the enemy without plan or purpose, each man fighting in his own way, we should not expect it to win many victories. If an army is to stand before an enemy, it must have a general over it who will keep all its parts working together.

The human body is composed of many organs, and as all the parts of an army must be made to work together, so must all the organs of the body be made to work together. Over all the body, therefore, a ruler has been set to govern the organs and to make them do their work when it needs to be done. This ruler is the *nervous system.* It is made up of the *brain* and *spinal cord,* and of the *nerves,* which run out from the brain and spinal cord to all parts of the body.

The brain and the spinal cord. The center of the nervous system is the brain and the spinal cord. The brain is enclosed by the cranium or bones of the head. The spinal cord lies in a canal in the spinal column. The brain and the cord are very soft and delicate, and they are protected by the strong bones about them.

Nerves and their work. From the brain and spinal cord the nerves run out and branch until

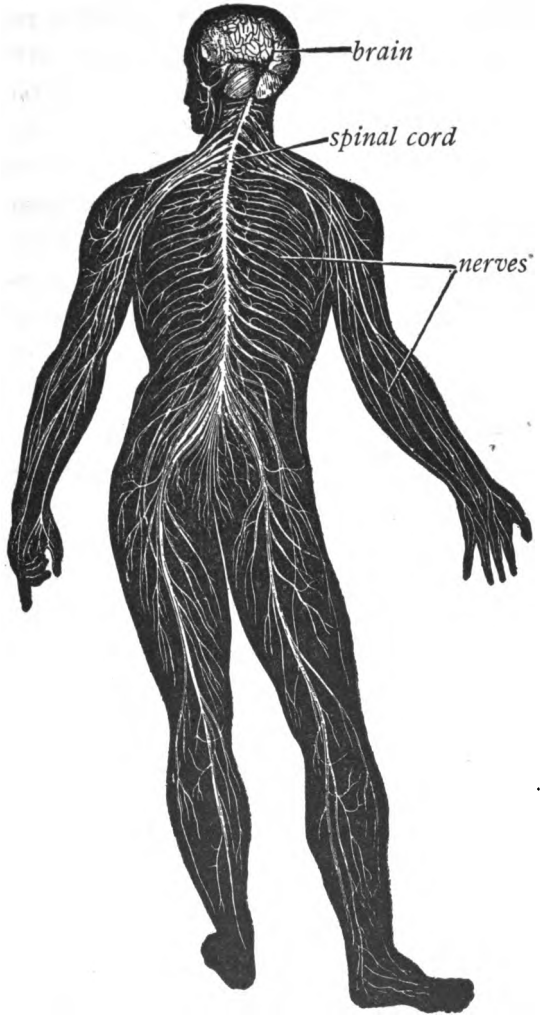


FIG. 64. The nervous system. From the brain and spinal cord, nerves run to all parts of the body.

they reach every muscle and the smallest parts of every organ. *The work of the nerves is to carry messages between the brain and the other parts of the body.* If you stick a pin into your finger, some of the thousands of nerves that end in the skin take a message to the brain. You then know that the finger was hurt. If you wish to lift your hand, your brain sends a message down the nerves to the muscles of your arm and causes them to move the hand. So whenever we hear, see, taste, smell, or feel, or whenever we move, we do so because the nerves carry messages either to or from the brain.

The work of the brain. The brain is the great center of the nervous system. It governs the heart and lungs. It gives us power to move when we wish to do so. It makes us able to see and to hear, to think and to feel, to know and to understand. Without the brain we should have no knowledge of where our hands and feet are, we could feel neither heat nor cold, and we should always remain in one place as does a tree. The mind of man has made him the ruler of the world, but without the brain the mind would be gone. There would then be no joy or love or knowledge in us, and our whole existence would be like the existence of a stone.

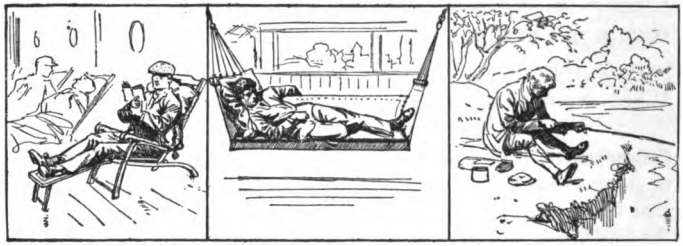
Questions: 1. Why must the body have a ruler to govern it? 2. What is the ruler of the body called? 3. Name the chief parts of the nervous system. 4. Where is the brain? 5. Where is the spinal cord? 6. How are the brain

and spinal cord protected? 7. What is the work of the nerves? 8. Explain what happens in the nerves when you stick a pin into your finger. 9. When you wish to move a part of the body. 10. Explain the work of the brain. 11. What would life be like without a brain?

Suggestions and topics for development: The resemblance of the nervous system to a telephone system. Make clear the fact that the brain is nourished in the same way as the other parts of the body, and that there is no such thing as a brain food.

CHAPTER TWENTY

THE CARE OF THE NERVOUS SYSTEM



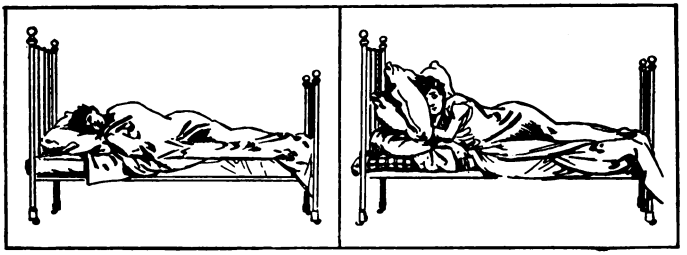
FIGS. 65, 66, and 67. Rest and quiet recreation build up tired nervous systems.

THE nervous system is the ruler of all the body, and if it is not kept in health the whole body must suffer. To keep it in health requires good food, pure air, exercise, freedom from germ diseases, — all the things that are needed by the rest of the body. There are also a few special points in regard to the care of the nervous system that it is well to know. In this chapter we shall discuss the need for rest and sleep, and the injury that comes to the nervous system from suffering pain.

The necessity for rest. No people have ever worked as the American people are now working. As a people, we hurry on from day to day, scarcely taking time to eat in a healthful manner. Even our play and our amusements are full of nervousness and excitement, and many of our people hardly know what an hour of quiet, peaceful rest is.

This kind of life is not healthful either for the body or for the mind, and while you are still in your

youth you should form the habit of resting. When you become tired at your play, lie down and rest. If you have a hard task and feel wearied after you have performed it, do not hurry off to play, but give your body the rest it needs. If you have a hard lesson, put your mind on it and study while you are at it; but if you find that your mind is tired and you are only looking at your book, stop and



FIGS. 68 and 69. A proper and an improper position for sleeping. Too high a pillow bends the spinal column to the side, interferes with the breathing, and disturbs the sleep.

rest. Get up and open the window and take a breathing exercise, while you think of something else. Endeavor to keep yourself calm and quiet, avoid fits of anger or great excitement, and do not overdo at your play or at your work. Learn that peace and quietness are as much a part of a healthful, useful life as the bustle and excitement in which some people always live. Learn to rest, and you will have learned something that will do much toward keeping your nervous system in health.

The necessity for sleep. The nervous system needs something that the rest of the body does not

require, and that is sleep. Without sleep we cannot remain in health. Young babies sleep nearly all the time, and the twelve or fourteen-year old boy or girl ought to have nine or ten hours of sleep every night. If you are sleepy at getting up time, go to bed earlier. There is no truth in the idea that a healthy person can have too much sleep; but it is true that in no way can you more surely wreck your nervous system than by depriving yourself of the sleep that you ought to have.

FIG. 70. The pain caused by toothache is a great drain on the nervous system.

In this connection it is of interest to know that many people who have tried sleeping outdoors find that they need about an hour less sleep each night when they sleep in the open air than when they sleep indoors. The nervous system is built up and restored more quickly when we breathe pure air than when we breathe impure air. So move your bed out on an upper porch, or make sure that you have plenty of fresh air in your room at night.

Pain. The suffering of pain has a very bad effect on the nervous system. Ill health and disease bring on old age faster than the passing of the years, and one reason why sickness so often leaves the body weakened and aged is that the nervous system has been wrecked by the pain that it has borne. A

week of toothache or of earache is a great drain on the nervous system. A corn that is continually causing pain can do as much to wear out your nervous system as an hour's extra work each day. Sometimes we learn to pay little attention to a dull pain and allow it to go on from week to week, but it is not right to do this. Pain is nature's danger signal; it is a call for help from some part of the body. Your nervous system can no more rest when these calls are coming to it night and day, than you could rest with the screams of some one who is calling for help constantly coming to your ears.

Have you toothache? Have you earache? Have you headaches? Do your eyes pain you? Do your feet hurt you? Have you pain in any other part of the body? If so, ask your parents to take you to a dentist or to a physician. For you ought to get up in the morning feeling fresh and rested; and you ought to go to bed, tired and sleepy perhaps, but free from pain.

Questions: 1. Mention three points that are important in the care of the nervous system. 2. Does a person who works quietly and rests when he needs it do any less work than the person who is hurrying all the time? 3. How many hours of sleep ought you to have? 4. How may a person know if he is getting enough sleep? 5. What should be done by a person who continues to suffer pain? 6. Why?

Suggestions and topics for development: How a vacation may best be spent to fit one for another year's work.

CHAPTER TWENTY-ONE

THE IMPORTANCE OF HABIT

FIGS. 71, 72, and 73. Keeping the teeth clean, breathing pure air, and going to bed regularly at an early hour are three habits that have much to do with keeping us in health.

WHEN the nervous system has done a thing once, it does it the second time more easily. When one has performed an act a great number of times, one's nervous system becomes so trained that it carries out the act easily and quickly and often without thought. When the nervous system becomes trained in this way, we say that we have formed a habit.

Just what happens in the nervous system when a habit is formed no one knows. But we do know that in the movements of the muscles, in the training of the mind, and in the building of the character, nothing has so great an influence as the habits we have formed.

Habits and health. It is not single acts, but habits, that destroy the health. It is not single acts, but habits, that build up the health.

You will not become stooped by bending over a desk one day, nor will you become straight by holding yourself erect some one time when you are walking down the street. Eating your dinner hurriedly one day and rushing back to school will not cause dyspepsia, nor will taking time to eat a few meals slowly cure it. The teeth decay, not because we leave them uncleaned for one day, but because we make a habit of leaving them uncleaned. The nervous system is injured, not by staying up late one evening, but by the habit of staying up late. The race for health is a long one, and it is not the short excited dash, but the patient plodding onward in the right course, that wins it. Habits and not acts are the important things in keeping the body in health.

Seven hygienic habits that you ought to form.

1. Keep your teeth clean.
2. Eat moderately and chew your food thoroughly.
3. Breathe pure air whenever it is possible to do so.
4. Go to bed regularly at a reasonable hour.
5. Take proper exercise and hold yourself erect.
6. Learn to rest and to keep yourself calm.
7. Guard yourself, so far as you can, from disease germs.

Form these seven habits and they will do more than all the medicines in the land to keep you in health.

Making hygienic habits a part of our lives. Our habits become a part of our way of living and

doing things, and we do not think of them as something that it requires extra work to carry out. If you will form the habits that we have mentioned above, you will soon clean your teeth as a matter of course and wonder how any one can feel comfortable without doing so. You will find yourself surprised that any one should want to make himself sick by eating too much or by swallowing his food without chewing it. You will think it strange that any one should live in a thick, stuffy atmosphere when there is pure air only the thickness of a window-pane away. You will feel your own hard muscles and almost pity the flabby-muscled people whom you meet. You will get out of patience with the person who potters around when he ought to go to bed; and you will be amused when you see some one get excited over nothing and run around like an ant that has lost its way. You will guard yourself from disease germs without feeling that you are taking extra trouble; and you will feel sorry for the poor persons all about you who needlessly suffer from germ diseases. Put into practice these health habits, and see if after a little while it is any special work for you to carry them out.

Mental habits. As we form habits of the body, so we form habits of the mind. And as it is the habits and not the single acts that are important to the body, so it is the habits that are important to the mind. A boy does not fail in his class because

he misses school one day, and he cannot pass his examinations with a high mark by studying his lessons for one day. It is the steady work day by day that gives the training of the mind, the store of knowledge, and the habits of work that enable a pupil to pass up from grade to grade in a satisfactory manner. Form the habit of studying and you will find that it is as easy to learn your lessons as it is to fail to learn them.

FIG. 74. Thirty-five years ago a young man tied this hickory tree in a knot. Now all the men in the world could not untie it. The habits that we form in youth are knots that we cannot untie in later years. (*From a photograph by Major Ben Cunningham, Marysville, Tennessee.*)

Youth the time when lasting habits are formed. Two or three days are enough to form or break a habit in a baby, but the older we become the harder it is for us to break old habits and to form new ones. Just as the bones harden as we become older, with whatever shapes they had in youth, so the nervous system becomes set in its ways of doing things as we advance in years. You should form habits that will carry you on in the road to health, and to respected, truthful, successful manhood and womanhood.

Questions: 1. What do we mean by a habit? 2. How are habits formed? 3. Is it as easy to form a good habit as a bad habit? 4. Name some habits that help to preserve the health. 5. How can one make these a part of his life? 6. How are mental habits formed? 7. Why should we form good habits in youth? 8. What is meant by the old saying, "As the twig is bent the tree is inclined"? 9. By the saying, "You can't teach an old dog new tricks"? 10. Do proverbs of this kind usually express some truth?

Suggestions and topics for development: The teacher will find the chapter on Habit in either James' *Psychology for Teachers* or James' *Talks to Teachers* (both published by Henry Holt and Company, New York) most suggestive and helpful.

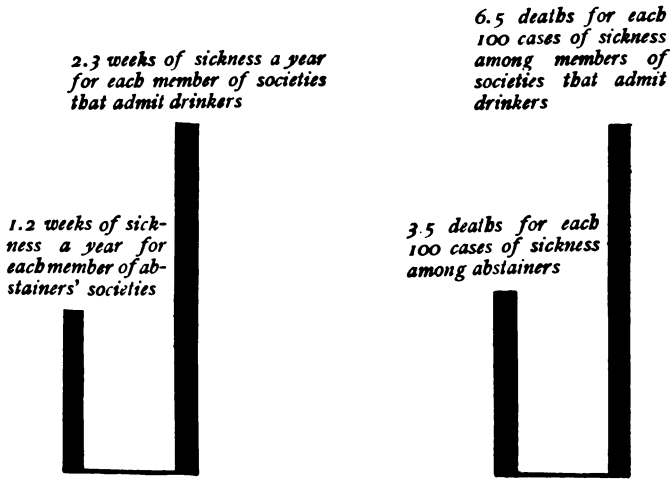
CHAPTER TWENTY-TWO

THE EFFECTS OF ALCOHOL ON THE BODY

As we have studied the great systems of organs that do the work of the body, we have learned that some of these organs are injured by the use of alcohol. This would be sufficient reason for avoiding alcoholic drinks, even though there were no other reasons. But aside from the damage done by it to separate organs, alcohol has far-reaching effects upon the body as a whole. These effects are more serious than the damage done to any single organ, and we cannot fully understand the evils which result from the use of alcohol until we know what these effects are.

Alcohol not a brain stimulant. It is well known that alcohol in large quantities is a cause of delirium tremens, paralysis, and insanity. The effect of small amounts of alcohol on the nervous system is not so well understood, and many persons still believe that a glass of beer or wine stimulates the brain and increases the working power of the mind and body. This idea is a mistake. Some typesetters were given an ounce (two tablespoonfuls) of alcohol on certain days, and a record was kept of their work. These men did one tenth less work and made one fourth more mistakes on the days when they used alcohol than they did on days when they had no alcohol, and the effects of the alcohol lasted through the second day. A man who took three ounces of alcohol each day for twelve

days could add figures only three fifths as fast as when he took no alcohol, while it took him more


2.3 weeks of sickness a year for each member of societies that admit drinkers
1.2 weeks of sickness a year for each member of abstainers' societies
6.5 deaths for each 100 cases of sickness among members of societies that admit drinkers
3.5 deaths for each 100 cases of sickness among abstainers

FIGS. 75 and 76. Some of the benefit societies in Australia take in as members both drinkers and non-drinkers, while others admit only those who do not drink. The short line in the left-hand figure represents the average amount of sickness a year for each member of the abstainers' societies, and the long line represents the average amount of sickness a year for each member of the societies that admit both drinkers and abstainers. Of the members of the abstainers' societies who were attacked by sickness, 3.5 in a hundred died (represented by the short line of the right-hand figure); of the members of the other societies who were attacked by sickness, 6.5 in a hundred died (represented by the long line of the right-hand figure).[1]

than three times as long to memorize a certain number of lines of poetry. These facts show that the power to do mental work is lessened by alcohol,

[1] From statistics compiled by Hon. H. Dillon Gouge, Public Actuary of South Australia.

even when taken in small amounts. This effect lasts for at least forty-eight hours after a small dose, and for this reason the person who drinks alcohol daily is never able to do his full day's work. *Alcohol is not a brain stimulant.*

The resistance of the body to the germs weakened by alcohol. Persons who use alcohol are more easily attacked by germ diseases than are those who do not use alcohol, and the drinkers suffer more severely when they are attacked. In pneumonia the death-rate among drinkers is nearly twice as high as it is among non-drinkers, and in one epidemic of cholera in Glasgow the death-rate among the alcohol users attacked was nearly five times as high as it was among the sober men who took the disease. Many of the foremost medical men are now convinced that the giving of alcohol to a patient who is suffering from pneumonia, diphtheria, cholera, typhoid fever, or other germ disease is not only useless but positively harmful.

Alcohol an ally of tuberculosis. In 1905 medical men who were interested in the study of tuberculosis met in a convention in Paris, to discuss means for preventing the spread of this disease. In this convention the following resolution was adopted: "*In view of the close connection between alcoholism and tuberculosis, this Congress strongly emphasizes the necessity and importance of combining the fight against tuberculosis with the*

struggle against alcohol." These men believe that the use of alcohol is responsible for a great deal of consumption, and they are able to give good reasons for their belief.[1]

Alcohol and length of life. The records of life insurance companies show that out of the same number of drinking men and total abstainers there are about fourteen deaths of drinking men for every ten among abstainers. The number of drinking men dying between fifty and sixty years of age is almost three times as great as the number of teetotalers. A man at twenty years of age may expect to live 42.2 years if he does not drink, but only 15 years if he uses alcohol. These figures show that alcohol very considerably shortens the life of the user.

Other effects of alcohol. The drunkard is not the only person who suffers from the results of his habits. A vast number of persons live in need of food, clothing, and shelter because the money that should have supplied these things has been

[1] In comparing death-rates in different occupations the hours and character of the labor, the chances of infection, the amount of exposure, the age of the workmen, and other factors must be taken into consideration, but statistics indicate that the use of alcohol increases the amount of consumption among the users. For example, American statistics (Census of 1900) show that the death-rate from consumption among all occupied males over ten years of age was 236.7, among brewers, distillers, and rectifiers was 256.8, among saloon and restaurant keepers was 285.6, and among clergymen was 123.5. English statistics (1899) show that where there

spent for drink. Among these persons there is an untold amount of disease and suffering and wretchedness. Almost one third of all persons who are supported by charity, and nearly one half of all homeless and friendless children in children's homes, owe their condition to some one's intemperance. "The worst feature of the poverty caused by alcohol is not the fact that the drunkard himself suffers, but the fact that innocent persons suffer far more than he."

What employers think of the use of alcohol. Some years ago 6976 business men employing 1,745,823 men were asked whether they employed men who drank. Of those who replied 5363 said they would not employ men who were known to drink and 1613 said they made no effort to learn the habits of their men. Most of the great railroads strictly enforce rules against drinking while on duty, and many of them will not employ a drinking man. Every year the number of positions open to the user of alcohol grows smaller.

were 1000 deaths among all occupied males there were 1427 deaths among an equal number of brewers.

According to figures collected from the records of the Gotha Life Insurance Company of Prussia by Professor Guttstadt, the number of persons in 1000 who die of tuberculosis among different classes of people is as follows:

All persons over 25 years	160	Hotel keepers	237
Ministers	76	Brewers	344
Physicians	113	Bartenders	556

What medical men think of the use of alcohol. The attitude of the great majority of medical men has been so well expressed by a recent writer [1] that we repeat the substance of his statement. "So I am bound to believe, on the evidence, that if you take alcohol habitually in any quantity whatever, it is to some extent a menace to you. I am bound to believe, in the light of what science has revealed, (1) that you are threatening the physical structure of your stomach, your liver, your kidneys, your heart, your blood vessels, your nerves, your brain; (2) that you are unquestionably lessening your power to work in any field, be it physical, intellectual, or artistic; (3) that you are in some measure lowering the grade of your mind, dulling your higher sense, and taking the edge off your morals; (4) that you are distinctly lessening your chances of maintaining your health

FIG. '77. There were 5363 employers who said that they would not employ men whom they knew to be drinking men, while only 1613 employers said that they did not ask about the habits of their men.

[1] Dr. Henry Smith Williams in *Alcohol: How It Affects the Individual, the Community, and the Race*, published by McClure, Phillips & Company, New York. This little book gives an accurate summary of what is scientifically known of the effects of the use of alcohol.

and of living to old age; (5) that you are adding yourself to the number of those whose habits cause more suffering and misery, disease and death, than do all other causes combined." To these conclusions we might add (6) that you are fastening upon yourself a habit that will lead many business men to refuse to employ you.[1]

Questions: 1. What are some of the effects of drunkenness on the nervous system? 2. What effects have small doses of alcohol on the power to do mental work? 3. How long does the effect of a single dose last? 4. How does the use of alcohol affect the resistance of the body to germ diseases? 5. To tuberculosis? 6. What opinion do many physicians hold in regard to the use of alcohol in the treatment of germ diseases? 7. How does the use of alcohol affect length of life? 8. How does the use of alcohol affect the drunkard's family? 9. What do employers think of the use of alcohol?

Suggestions and topics for development: Make clear that Figures 75 and 76 are not comparisons between drinkers and abstainers, but that the morbidity and mortality rates in a society composed of drinkers only would be higher than either of those shown. Inquire of the children as to what they know of the attitude of life insurance companies toward moderate drinkers.

[1] All authors are agreed that the use of alcohol by the normal person has never produced any good. Small amounts may be taken even for a long time without producing any very evident changes, but even these small amounts are in no sense to be looked upon as good. The well-proved statement that a single glass of beer interferes markedly with the ability to think and the ability to work is quite enough argument for letting alcohol, in any form. alone. — DR. MARTIN H. FISCHER.

CHAPTER TWENTY-THREE

THE EFFECTS OF TOBACCO ON THE BODY

"LESS harm would be done by tobacco if it were more harmful." This sentence tells a great truth, and it explains why there are more tobacco users to-day than ever before. The harm that tobacco does is not felt in a day or a month, and many tobacco users are unable to see that the habit is injuring them. Many other persons feel that they would be better off without tobacco, but have the habit of using it so firmly fixed that they are unable to break it. While the use of tobacco has widespread effects upon the whole body, we shall study only its effects upon the heart, the digestion, and the nervous system.

The effect of tobacco upon the heart. Tobacco contains a poison called nicotin, which is highly injurious to the heart. In those who use tobacco to excess, the heart beats more rapidly than it should, while the force of its beat is greatly lessened. When the habit has been continued for a long time, the heart's action sometimes becomes very irregular, at one time beating too rapidly, at another too slowly, and occasionally missing a beat altogether. This is known as tobacco heart. While it is a serious condition, it usually disappears when the use of tobacco is stopped.

The effect of tobacco upon the digestive organs. The worst effects of tobacco upon digestion are due to the fact that the heart is weakened

and the digestive organs do not get a sufficient supply of blood. The digestive juices are lessened in amount, so that the food cannot be promptly digested. This trouble comes on slowly, and often is not noticed by the person himself. Even when it becomes serious, the tobacco user often believes that his indigestion is due to some other cause. When such a person gives up the tobacco habit, he is usually surprised to find that there is great improvement in his powers of digestion and in his general health.

The effect of tobacco upon the nervous system. When used in moderate amounts, tobacco soothes and quiets an excited or worried person, enabling him to go on with his work for a time. But often one who has his mind cleared of worry in this way forgets the importance of the work he has to do, and idles away his time instead of going earnestly to work to finish his task. When used in larger amounts, tobacco makes the whole nervous system more irritable. The brain of the tobacco user may become so active that he cannot sleep. His muscles are weak, and he cannot control them, his hands tremble, and he becomes so restless that it is impossible for him to remain quietly at work.

Tobacco and scholarship. The worst effects of tobacco upon the nervous system are its effects upon the mind. Wherever smokers and non-smokers have been compared, it has been found that

non-smokers are much better students. They not only prepare their lessons more easily and more quickly, but they retain what they have learned longer than the smokers. Of 2336 smokers in the public schools of one city, only 320 were able to keep up with their classes, while only 16 were reported as "bright" or "better than average" students. Most of the backward boys in the schools are recruits from the ranks of tobacco users.

Tobacco a nuisance. Even if the use of tobacco were harmless, it would still be a nuisance to other people. Yellow fingers and stained teeth are unpleasant sights, and many people are made sick by the odor of tobacco smoke. No one has a right to do that which makes his neighbors uncomfortable. No one has a right to do that which will injure his own body. Tobacco is both harmful to the user and annoying to others, and the only sensible and right thing to do is to avoid its use.

Questions: 1. Why is the use of tobacco on the increase? 2. Why do those who know that tobacco is injuring them continue its use? 3. What are the effects of tobacco upon the heart? 4. Can this condition be cured? 5. In what way does tobacco interfere with digestion? 6. What effect have small amounts of tobacco on the nervous system? 7. Large amounts? 8. How does its use affect scholarship? 9. Give two final arguments against the use of tobacco.

Suggestions and topics for development: The economic side of the tobacco question. The effect of tobacco on the growth and development of the body.

CHAPTER TWENTY-FOUR

THE EYES AND THEIR CARE

FIGS. 78 and 79. In writing the light should come from the left side, and the seat and desk should be the proper height to make it easy to keep the body and head erect and the shoulders even. In reading the light should come from the side so that it will shine on the book and not into the eyes.

WE look at the sky at night and see it studded with stars. Sometimes we see the round moon like a great quiet mother among the twinkling stars. We look at a rose and we see its beauty and the richness of its color. We know its size and the shape of its leaves.

What is it that comes from the stars and the rose to the eye? It is light. What does the light do in the eye that causes us to see? It starts messages in the nerves of the eye, and these messages are carried to the brain. What do we learn from these messages? We learn from them the greater part of

all that we know of the world about us. To get an idea of the importance of the eyes and of the messages that come from them, think how helpless you would be if you had no eyes to guide you; how little you would know if you should forget all that you have learned through their use; how much pleasure you get from seeing the world about you, and how dreadful it would seem to pass your life in the darkness of a long unlighted night.

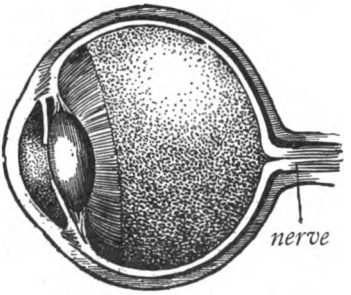


FIG. 80. The light passes back into the eye and starts messages in the nerve to the brain.

How the eyes are protected. The eyes are protected by the eyelids, eyelashes, and eyebrows. They are bathed and washed free from dust by the tears. These are secreted by a gland in the outer part of the upper eyelid and drain into the nose through a little duct from the inside corner of the eye.

How the eyes are moved about. Each eye is moved about by six little muscles, which can turn the eye toward the object that we wish to see. A person who squints or is cross-eyed has some of his eye muscles shorter than others. A skillful physician can remedy this trouble if it is taken in time.

Near-sighted and far-sighted persons. Images or pictures of the things that we see are formed in

the back of the eye, just as an image is formed in the camera of a photographer. It is these images that start the messages along the nerves from the eye to the brain. From these messages we can tell the size, form, and color of objects. We can tell many other things about them, such as whether they are rough or smooth and how far away they

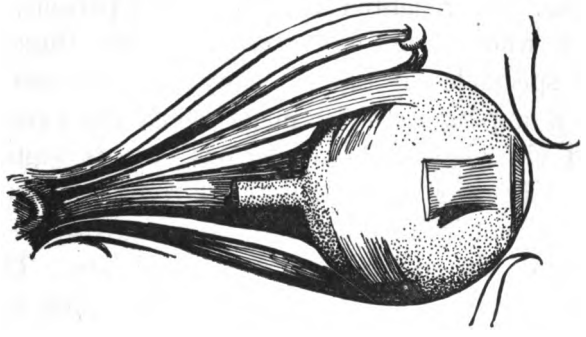


FIG. 81. The muscles that move the eye. When you read with a book very close to your eyes, as you do when you bend forward over your desk and rest your chin on the book you are reading, you put a great strain on the muscles that turn the eyes inward.

are. In the eyes of a near-sighted person the images of near-by objects are clear and distinct, but the images of distant objects are blurred and indistinct. In far-sighted persons the images of distant objects are clear, but it is a great strain on the eyes to see near-by objects clearly. In some eyes the images are always confused, and it is not possible for the person to see objects at any distance clearly. All these troubles can be corrected and the images

made distinct by wearing spectacles that are properly fitted to the eyes. A person who holds his book less than twelve inches from his eyes when he is reading is near-sighted and needs glasses.

The importance of fitting the eyes with spectacles. If the images that are formed in the eyes are not clear and distinct, the eyes will always give trouble. Near-sighted and far-sighted persons, and others who do not see clearly, should, therefore, have spectacles at once. Many cases of nervousness disappear as if by magic when the eyes are fitted with glasses. Many persons who are wretched from indigestion find out that the trouble is in their eyes and not in their stomachs, and that their health is completely restored by wearing glasses. Thousands of people are suffering from blinding headaches, when all that is needed to save them from this pain is a pair of spectacles. Even the muscles are affected by the eyes, for it has been found that when boys who needed glasses began to wear them they became much faster runners. This was because the boys were suffering from eye-strain, and their nervous systems and general health were not in good condition, although the boys themselves had never realized it.

Eye trouble very common among school children. Of 432,000 school children examined in Massachusetts in 1907, more than one in five had defective vision. In the United States it is esti-

mated that there are 2,500,000 school children who ought to be wearing glasses.

Do you hold a book close to your eyes when you are reading? Are you falling behind in your school work because you cannot see what is written on the blackboard? Do your eyes smart and ache after you have been studying for some time? Are they red and inflamed? Do you have headache or stomach trouble? If so, try to have your eyes examined and to get glasses if you need them. It is a mistake to think that going without glasses will help a person to outgrow eye trouble. It is best to go to an oculist for glasses, and it is a mistake to go to a travelling optician, whom you may never see again; for he may be more interested in getting your money than in helping your eyes.

FIG. 82. This boy carries his head on one side because of eye trouble. He needs to be examined by an oculist. Do you carry your head on one side or turn it to one side when you look closely at objects? (*After Gould.*)

The importance of a good light for work. The eyes are often injured by working in a poor light. It is a bad plan to try to read between sundown and dark, as one may not notice that darkness is coming on and may strain the eyes without know-

ing it. Persons often carelessly seat themselves too far from the lamp when they read. Dark schoolrooms are injuring the eyes of thousands of children. A bright light shining into the eyes is even worse than too dim a light, and one should not face a window or a lamp when reading or studying. Light from the left side is best for writing, for then the shadow of the hand does not interfere with the work. A flickering gas light should not be used for reading. A book printed on shiny, glazed paper is hard on the eyes.

Resting the eyes. Using the eyes in close work, such as reading, embroidering, or sewing, causes the eyes to become tired. When doing such work it is a good plan to close the eyes for a few minutes occasionally or to look out of a window in order to rest the eye muscles; or one may rest the whole body as well as the eyes by standing up and going through one of the exercises described in Chapter Twenty-seven. Reading while lying down, walking, or riding in a street car or train quickly tires the eyes, and if it must be done should be kept up for only a very short time. Serious eye troubles are apt to follow measles and scarlet fever, and the eyes should be shielded from bright light and rested during these diseases and during recovery from them.

Catching diseases of the eye. There are a number of catching diseases of the eye (often called "pinkeye" or some similar name) that are caused

by germs. The germs are carried from one person to another on towels, on the hands, by flies, and in other ways. These diseases often leave the eyes weak and inflamed for life, and you should make every effort to avoid the germs that cause them.

Do not wash your eyes in a public wash basin or wipe them on a public towel. Do not rub them or pick at them with your fingers. Boracic acid dissolved in water (the solution is not too strong as long as it is all dissolved) and dropped into the eyes once or twice a day will often help to kill bacteria and relieve the smarting and burning that comes from red and inflamed eyes. Strong eye washes and eye salves should not be used without the advice of a physician.

FIG. 83. Germs often get into the eyes from the fingers.

Foreign bodies in the eye. When a particle of dust or other foreign body gets into the eye, *the eye should not be rubbed.* Sometimes the body can be washed out with clean water; or if the upper eyelashes are taken between the finger and the thumb and the eyelid drawn down and out, the position of the body may be changed until it can easily be removed. Some persons are skillful enough to turn the eyelids wrong side out and wipe the particle off with a cloth

or a tuft of cotton. When this is done, the fingers, the cloth, and everything that touches the eye should be absolutely clean, for it is an easy matter to get into the eye germs that will cause great trouble. Sharp pieces of metal ought to be removed by a physician or an oculist before they cut deep into the eye and start inflammation.

Questions: 1. How does the light that enters our eyes cause us to see? 2. How are the eyes protected? 3. How are they cleansed? 4. Where do the tears come from? 5. Where do they go after they leave the eye? 6. How are the eyes moved? 7. Of what advantage is this to us? 8. What causes a person to be cross-eyed? 9. What is the trouble with the images in the eyes of a near-sighted person? 10. How may these difficulties be remedied? 11. Why should this be done? 12. What are some of the symptoms of eye trouble? 13. Explain what kind of light is needed in reading and studying, and how the light should fall on the page. 14. How may the eyes be rested? 15. How do germs that cause diseases of the eye spread from one person to another? 16. Tell how to remove a foreign body from the eye.

Suggestions and topics for development: The teacher should test the eyes of the pupils in the room. If no test card is provided by the school, one can be obtained by sending ten cents in stamps to World Book Company, Yonkers-on-Hudson, New York.

Some children will be found who cannot read the writing on the blackboard from the back of the room. These children should be placed on the front benches, and the parents should be prevailed on to provide the needed glasses as soon as possible.

The teacher should also look to the proper lighting of the schoolroom, paying special attention to whether parts of it are too dark and whether the children are seated facing the light.

CHAPTER TWENTY-FIVE

THE EARS AND THEIR CARE

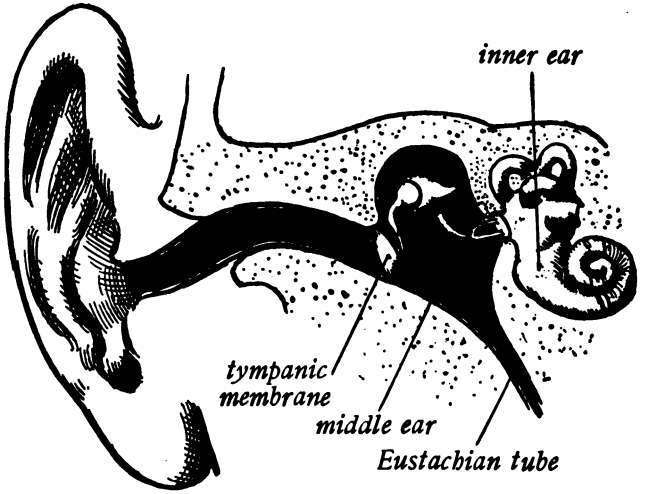


FIG. 84. The ear. The ear is composed of an outer, a middle, and an inner part.

WHEN you throw a stone into water, the stone causes waves to run out in the water. When you ring a bell, the bell causes waves to run out in the air. When you shout, when a whistle blows, or when a bird sings, waves are made to run through the air. When these waves strike the ear, you hear the bell, the shouting, the whistle, or the singing of the bird. If the air waves are large, the sound will be loud. If the air waves are small, the sound will be faint in your ears.

The function of the ear. The ear collects the sound waves and makes them strike on the ends of the nerves of hearing. This causes the nerves of

hearing to carry messages to the brain, and when these messages arrive in the brain we hear the sound. Certainly nothing in the world is more wonderful than the human ear, for it changes the air waves that come from the strings of a violin or piano into the sweetest music, and by collecting the waves that are caused by the voices of our friends, it brings to us the thoughts that they wish to express to us.

The structure of the ear. The ear has three divisions: the outer, the middle, and the inner ear. The outer ear is made up of the part that we see and a canal that runs down into the head. At the bottom of this canal is a little skin-like membrane called the *tympanic membrane.* This separates the outer and the middle ear.

The middle ear is a little cavity in the bone of the skull. It is filled with air, and from it a little tube runs to the throat. In the middle ear are three small bones which stretch across from the tympanic membrane to the inner ear. The inner ear is filled with liquid, and in this liquid lie the endings of the nerve of hearing.

How we hear a sound. The outer ear collects the sound waves and turns them down the canal to strike against the tympanic membrane. This sets the tympanic membrane to swinging, and the membrane puts the chain of little bones in motion. The motion of the bones disturbs the liquid in the

inner ear and causes waves in it. These waves wash over the ends of the nerve of hearing and start messages to the brain, and when these messages reach the brain we hear the sound.

The care of the ear. Practically all the serious troubles of the ear come from germs that work up the tube from the throat into the middle ear. In Figure 26 you can see that the openings of these tubes are high up in the throat, where the matter that falls into the throat from the nose in cases of catarrh passes over them and where they may be pressed upon and closed by adenoid growths (compare Figure 37). Most children who are hard of hearing have nose or throat trouble, and most older persons who are deaf suffered from these troubles when they were young.

The danger from running ears. A running ear means that there are germs in the ear that are causing inflammation and forming the same kind of matter that comes from boils and sores. This trouble ought by all means to be attended to at once, for in a running ear there is already a hole in the tympanic membrane, and there is danger that this membrane will be destroyed or that the chain of bones will be broken down and incurable deafness caused. There is always the danger also that the germs will work through to the brain, which lies close above the ear, and cause the disease that is called meningitis.

A running ear ought to be treated with medicines that will kill the germs in it, and this ought to be done by a physician. A child with a running ear ought also to be examined and treated for the nose or throat trouble that in most cases has caused the ear to become infected. Plugs of cotton should not be worn in the ear, for they do damage; the

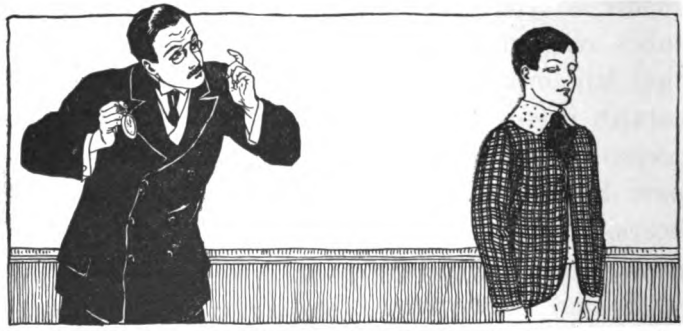


FIG. 85. Testing a boy's hearing by trying how far he can hear the ticking of a watch.

ears ought to be cured so that the cotton will not be needed. An earache may sometimes be kept from coming on at night by wearing a cap over the ear or by sleeping on a hot-water bottle, and a doctor can usually give something that will stop the pain for the time.

Do you suffer from earache? Have you a running ear? Are you hard of hearing and falling behind in your school work because you cannot hear what is said in the school room? If so, try to have your ears examined and treated. Do not let any one tell

you that you will probably outgrow your trouble, for most of the people who are hard of hearing to-day are in that condition because they were neglected in childhood, and without treatment you are likely to grow into a life of deafness. The ears were made to hear with and not to rumble and roar and wreck the nervous system with pain, and you should try to get yours to serve the purpose for which they were intended. A physician who understands the treatment of ear troubles will not tell you to wait and let them get well of themselves.

Foreign bodies in the ear. If a live insect gets into the ear, it can be drowned and the buzzing stopped by pouring water or oil into the ear. Only a physician should try to take anything out of the ear, for there is always danger that an unskilled person will drive the object through the tympanic membrane. Sometimes the bitter wax which is formed in the canal of the ear blocks it up and interferes with the hearing. It should be removed by a physician.

Questions: 1. How is sound caused? 2. Why are some sounds loud and others faint? 3. What is the function of the ear? 4. Name the divisions of the ear. 5. What is in the middle ear? 6. How is it connected with the throat? 7. What is found in the inner ear? 8. Explain what happens in the ear when we hear a sound. 9. How do germs get into the ear? 10. Why are persons who have catarrh or adenoids especially liable to diseases of the ear?

11. What is the cause of running ears? 12. Why should running ears never be neglected? 13. What should be done when an insect gets into the ear? 14. Why is it dangerous for any one but a physician to try to remove bodies from the ear?

Suggestions and topics for development: The function of the Eustachian tube. Why a cold sometimes causes deafness. The teacher should test the hearing of the children in the room. Some who are hard of hearing will always be found, and these ought to be seated on the front benches. A fairly accurate test of hearing can be made with a watch. Watches differ in the loudness of the tick, and a considerable number of ears should be tested with the same watch to find how far it ought to be heard. In making the test a quiet room is necessary and the watch should always be held in the same way. To make a test of hearing have the child sit down, close his eyes, and cover one ear with his hand. Then at different distances try if he can hear the ticking of the watch. Sometimes hold the watch behind your back or muffle it with the hand or with a handkerchief when the child thinks that it is being held up for him to hear. This is necessary because some people can hardly tell the difference between what they hear and what they imagine they hear. Both ears should be tested, and any child who seems hard of hearing should be examined by a physician who understands ear troubles. It is stated that two thirds of all deafness is caused by adenoids.

CHAPTER TWENTY-SIX

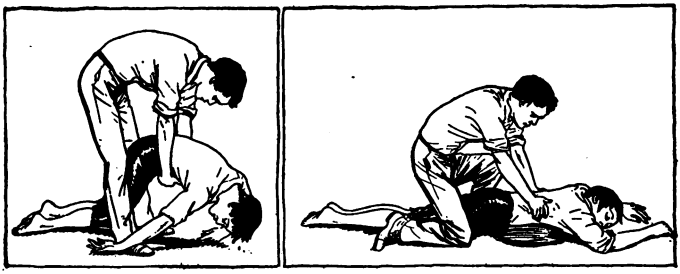
ACCIDENTS

In case of accident in the country, and sometimes even in the city, it is not always possible to secure a physician until considerable time has passed. Every one therefore should understand what is best to be done in some of the more common accidents. When one is called on to use this knowledge, he should above all else try to keep a cool head and to act promptly, for often a great deal depends on doing something for the patient at once.

Broken bones. If a broken arm or leg is allowed to be bent or doubled, there is danger that the ragged ends of the bones will cut and wound the muscles, blood vessels, and nerves. Keep the limb straightened out until a physician arrives.

Burning clothing. If your own clothing takes fire, *do not start to run.* Lie down and wrap yourself in a rug, blanket, or coat, or roll over and over to put out the flame. Do not stand up so that the flame will come up about your face, for the great danger comes from breathing in the flame. If another person's clothing takes fire, wrap a rug or blanket about him, and throw him down. Protect your face as much as possible while doing this, and if you must pass through a burning building close to a flame, hold something before your face. Until a physician arrives, burns may be protected from the air with cloths spread with vaseline or dipped in water that contains baking soda.

Fainting. Lay the patient flat on his back so that the blood will flow easily to the head. Cold water sprinkled on the face or ammonia held under the nose will help to restore consciousness. Fifteen drops of ammonia given in a third of a glass of



FIGS. 86 and 87. In case of drowning, first drain the water from the lungs, as shown in the left-hand figure. Then as quickly as possible get the air to passing into and out of the lungs, using the method shown in the right-hand figure.

water or a cup of strong coffee will strengthen the patient.

Apparent drowning. Drain the water from the patient's lungs by holding him for a few seconds as shown in Figure 86. Then quickly lay him in the position shown in Figure 87 with a folded blanket or coat under his chest. Place the hands on either side of the back over the lower ribs. Throw the weight of the body steadily downward on the hands and drive the air out of the lungs. Take the pressure off the body without lifting the hands and allow the air to come into the lungs. Repeat about fifteen times a minute. Keep the patient as warm

as possible. The artificial breathing should be kept up for an hour or more if the patient does not revive sooner.

Poison ivy. Bathe the affected parts in a weak solution of potassium permanganate. This can be made up by dissolving a small crystal of the permanganate in a basin of water. This medicine stains the skin, and when the face is affected it may be advisable to consult a physician about another remedy.

Poisoning. Bottles that contain poisons should not be kept among medicines, and it is well to paste on these bottles strips of sandpaper, so that they can be recognized even in the dark. When a poison has been taken by accident, a physician should be called as quickly as possible. In the meantime the following remedies may be used:

Carbolic acid. Use alcohol (whiskey, brandy, or rum will do), oil, or milk.

Bichlorid of mercury (also called mercuric chlorid and corrosive sublimate). Give milk or white of egg. Cause vomiting by giving a tablespoonful of mustard in a glass of warm water, warm salt water, or large quantities of hot water. Tickle the throat with a feather or thrust the finger into the throat to bring on the vomiting.

Arsenic. Cause vomiting, and if any medicine that contains iron is at hand, give it. The poison in Fowler's solution, Paris green, and Rough-on-Rats is arsenic.

Opium, laudanum, nightshade, and Jimson weed poisoning. Give strong coffee or ammonia. Keep the patient awake by walking him about, slapping him, or throwing cold water over him if necessary. Cause vomiting.

Questions: 1. What danger must be guarded against when a bone of one of the limbs is broken? 2. Tell what should be done in case the clothing takes fire. 3. In case of fainting. 4. How should you treat a person who was suffering from apparent drowning or gas suffocation? 5. Tell what should be done in case of poisoning with some of the more common poisons.

Suggestions and topics for development: Show the class how to carry on artificial respiration. Write to the Department of Agriculture at Washington for a bulletin on poisonous plants, and teach the children to know and to avoid the poisonous plants of the region.

CHAPTER TWENTY-SEVEN

SOME SIMPLE EXERCISES FOR USE IN SCHOOLS

IN this chapter are some simple exercises that may be given in school when the pupils have become tired of study and their muscles have become cramped from sitting for some time in their seats. The teacher should select exercises so that each day the muscles of the whole body will be brought into play, and the school should be trained to go through them in a quiet, orderly manner, so that little time will be lost from the lessons. The windows should be thrown wide open before beginning the exercises (page 49). In warm weather some teachers may prefer to give the exercises outdoors.

Position while exercising. The most important point is to hold the body erect. The head should be stretched up as high as possible, as though the body were hanging by the back of the top of the head. This will straighten out the spinal column; hold the neck straight with the chin close to the neck, and lift the ribs up off the lungs (see Figure 53). In the following exercises, whenever the command "*Position!*" is given, it means that the head is to be held in this way, with the hands at the sides. The position for resting is to stand with the feet even and wide apart, and the arms crossed behind the back and resting on the backs of the hips.[1] The trunk and head should be held erect but

[1] If preferred the position shown in Figure 57 may be used in resting.

not rigid while resting. The command "*In place!*" means to take this position, and the command "*Rest!*" means to remain in the resting position until the next command is given. The command "*In place, rest!*" should be given after each exercise.

Commands. There are always two parts in the commands; one part tells *what to do*, and the other part tells *when to do it.* In the commands for these exercises the parts which tell when to do a thing are printed in black letters. For example, the command, "Hands on hips, **place**," means to place your hands on your hips when the teacher says "Place!" In some of the exercises the complete commands and counting have not been given. The teacher will easily understand what these should be and will give them.

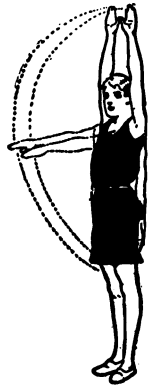


FIG. 88.

A. Arm raisings.

EXERCISE 1. Arm raisings through front horizontals to high over the head (Fig. 88).

Raise the arms high over the head, knuckles leading (*i. e.* the backs of the hands going before the palms), through a front horizontal position. Keep the arms and fingers stretched out stiff and straight. The teacher should count 1 as the arms are raised, and 2 as they are lowered. Keep the head stretched up.

Command: *Position.*

Arm raisings through front horizontals to high over the head, **up—down.**

(Teacher counts:)

1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2.[1]

In place, **rest.**

EXERCISE 2. Arm raisings through front horizontals to high over the head, rising on the toes.

The same as Exercise 1, but rise on the toes as the arms are raised and bring the heels down as the arms descend.

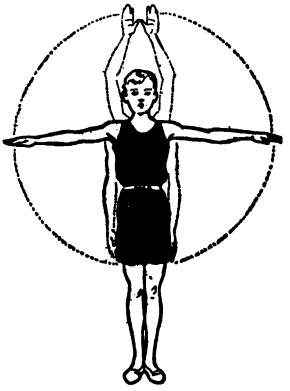


FIG. 89.

Command: *Position.*

Arm raisings through front horizontals to high over the head, rising on toes, **up—down.**

1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2.

In place, **rest.**

EXERCISE 3. Arm raisings through side horizontals to high over the head (Fig. 89). Directions as for Exercise 1, but raise the arms through a side horizontal position, bringing them up over the head with the palms forward, thumbs touching. Do not bend the arms at the elbows.

Command: *Position.*

Arm raisings through side horizontals to high over the head, **up—down.**

[1] If preferred, the teacher may count 1, 2, 3, 4, 5, 6, 7, 8.

1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2.

In place, **rest.**

EXERCISE 4. Arm raisings through front horizontals, descending through side horizontals.

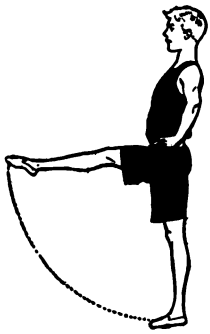


FIG. 90.

Raise the arms as in Exercise 1, and bring them down as in Exercise 3. Vary the exercise by sometimes rising on the toes.

Command: *Position.*

Arm raisings through front horizontals, descending through side horizontals, **up—down.**

1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2.

In place, **rest.**

These arm exercises can be varied by having the pupils go through them with either the right or left arm, with both arms, or with the right and left arms alternately.

B. Leg Exercises.

I. *Leg Raisings.*

EXERCISE 5. Leg raising to front horizontal (Fig. 90).

The leg should be brought forward and upward with the toe pointed down to bring the foot as nearly as possible in a straight line with the leg. Do not bend the leg at the knee. Head and trunk erect; *i. e.* "stand tall."

Command: *Position, hands on hips*, **place.**

Leg raising to front horizontal, right leg, **up—down.**

1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2; 1, 2.

Left leg, **up.**[1]

1, 2; (repeat eight times).

In place, **rest.**

EXERCISE 6. Leg raising to side horizontal.

Count and position of leg and foot as in Exercise 5, but raise leg to the side. Do not let the body lean over to the side.

Command: *Position, hands on hips,* **place.**

Leg raising to side horizontal, **up—down.**

FIG. 91.

EXERCISE 7. Leg raising to back horizontal.

Count and position of leg and foot as in Exercise 5, but raise leg to the back.

Command: *Position, hands on hips,* **place.**

Leg raising to back horizontal, **up—down.**

II. *Leg Flexions (Bendings).*

EXERCISE 8. Leg flexion forward (Fig. 91). Position of toe as in Exercise 5. Leg from knee down should be *vertical.* Raise knee toward chin as far as possible, keeping the body and head erect.

[1] This command should be given instead of the last three counts while the right leg is being raised. The exercise will not then be stopped while the command is being given.

Command: *Position.*

Hands on hips, **place,**

Leg flexion forward, right leg, **up — down.**

1, 2; (repeat eight times.)

Left leg, **up — down.**

1, 2; (repeat eight times.)

In place, **rest.**

EXERCISE 9. Leg flexion backward.

Count and position of foot as in Exercise 5. Bend the leg backward at the knee. Raise the foot as high as possible, *keeping the knees close together and even.*

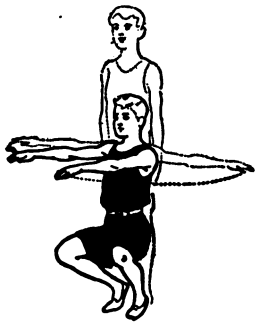


FIG. 92.

Command: *Position.*

Hands on hips, **place.**

Leg flexion backward, right leg, **up — down.**

III. *Squat.*

EXERCISE 10. Half squat, with arms to front or side horizontals (Fig. 92).

Lower the body, raising the heels, bending only at the knees and hips. The knees should be turned out so that they will be in a straight line with the toes. As the body descends, raise the arms to front horizontal (extended straight out in front, palms down), or to side horizontal (extended out at sides); now lower the arms to the sides as legs are straightened. *Head and trunk erect.*

Command: *Position.*

Half squat, with arms front (or side) horizontals, **squat.**

1 (lower body and raise arms), 2 (lower arms and raise body); (repeat eight times.)

In place, **rest.**

C. Body flexions.

EXERCISE 11. Trunk forward flexion (Fig. 93). Place the hands on the hips, and bend the body forward. Keep the legs straight at the knees and the head in a straight line with the trunk, the body bending only at the hips.

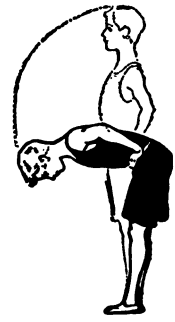


FIG. 93.

The count for body movements should be slower than for limb movements

Command: *Position.*

Hands on hips, **place.**

Trunk forward, **bend,** *upward,* **raise.**

1, 2; (repeat four times.)

In place, **rest.**

EXERCISE 12. Trunk sidewise flexion. Position as for Exercise 11. Do not let the head bend over toward the shoulders.

Bend alternately to the right and to the left.

Command: *Position.*

Hands on hips, **place.**

Trunk sidewise, **bend,** *upward,* **raise.**

1, 2; (repeat four times.)

In place, **rest.**

EXERCISE 13. Trunk backward flexion.

Position and directions as for Exercise 11. Bend the body backward. Do not let the legs bend at the knees.

Command: *Position.*

Hands on hips, **place.**

Trunk backward, **bend,** *upward*, **stretch.**

1, 2; (repeat four times.)

In place, **rest.**

EXERCISE 14. Alternate trunk flexions. Bend forward, then to the right, then to the left, and then backward.

Command: *Position.*

Hands on hips, **place.**

Alternate trunk bendings, **bend.**

1, 2; (bend each way and repeat once.)

In place, **rest.**

The exercises in bending may be varied by clasping the hands together and placing them on top of the head instead of on the hips.

D. Breathing exercises.

EXERCISE 15. Breathing exercise, hands at sides. In all breathing exercises stand tall (page 83).

Inhale and exhale slowly and steadily through the nostrils. Keep the head and body erect as the air is exhaled. At the command **inhale,** take in a full breath, and hold until the command **exhale.**

Command: *Position.*

Breathing exercise with hands at sides, **inhale — exhale** (repeat four times).

In place, **rest.**

EXERCISE 16. Breathing exercise, hands on ribs.

Place the hands over the lower ribs, and as the air is exhaled, press on the ribs with the hands.

Command: *Position, hands on ribs,* **place.**

Breathing exercise, hands on ribs, **inhale — exhale** (repeat four times).

In place, **rest.**

EXERCISE 17. Breathing exercise, arms raised through front horizontals high over the head. As the air is inhaled, slowly raise the arms as in Exercise 1, and let them come down again slowly as the air is exhaled. Keep the arms and fingers stretched out straight and stiff.

Command: *Position.*

Breathing exercise, arms raised through front horizontals to high over the head, **inhale — exhale** (repeat four times).

In place, **rest.**

EXERCISE 18. Breathing exercise, arms raised through side horizontals to high over the head. Position and movement of arms as in Exercise 2. Raise the arms as the air is inhaled and lower them as the air is exhaled. *Head, arms, and fingers stretched up.*

Command: *Position.*

Breathing exercise, arms raised through side hori-

zontal to high over the head, **inhale—exhale** (repeat four times).

In place, **rest.**

EXERCISE 19. Breathing exercise, arms raised through front horizontals and lowered through side horizontals. The same as Exercise 17, but move the arms as in Exercise 3.

EXERCISE 20. Breathing exercise, arms raised through front horizontals high over the head, rising on toes. The same as Exercise 17, but rise on the toes as the air is inhaled and slowly bring the heels down as the air is exhaled.

CHAPTER TWENTY-EIGHT

DISEASE GERMS

A PERSON who lives with a consumptive sometimes catches consumption. A man takes care of a neighbor who has typhoid fever, and he too takes typhoid fever. A child brings measles or whooping cough to school, and soon great numbers of the children have the same disease.

FIG. 94. Disease germs are so small that they can be seen only through a powerful microscope.

Why are some diseases "catching"? What is there about a person who has consumption, typhoid fever, or measles that should cause another person to take the disease? What passes from a sick person that causes other persons to become sick, and how does it pass? Let us see if we can find the answers to these questions.

Catching diseases caused by germs that are passed from one person to another. All catching diseases are caused by germs, and when a person catches a disease, he does so by getting germs into his body. Every case of smallpox is caused by germs that came from some other case of smallpox. All cases of measles and mumps are caused by germs that come from other cases of these diseases. All the many million cases of catching diseases that are found in our country each year are caused by

germs that come from other cases of these diseases. Get it firmly fixed in your mind that the germs that make us sick do not fall from the clouds or spring up from the earth, but come from the people who are sick with germ diseases.

Disease germs very small. We do not see the germ as it passes from the person who gives us grip or measles. This is because disease germs are so very small that we can see them only with a powerful microscope. They are so tiny that millions of them can swim in a single drop of water. Even when there are hundreds of millions of them on the hands or on a drinking cup, the hands or the cup may yet seem to be perfectly clean. We can see a street car coming and get out of its way, but germs we must learn to escape without seeing them.

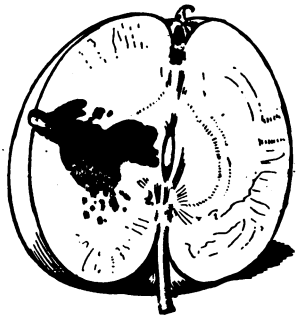


FIG. 95. If material from a rotten apple is packed into a hole in a sound apple, the rot, which is a catching disease, will spread through the whole apple.

Some diseases that are caused by germs. Among the diseases that are caused by germs are colds, catarrh, diphtheria, pneumonia, and consumption; typhoid fever, dysentery, cholera, and all the diseases of the intestine from which so many little children die; boils, carbuncles, blood poison-

ing, tonsillitis, appendicitis, and inflamed sores and wounds; malaria, lockjaw, meningitis, and leprosy; whooping cough, scarlet fever, measles, chicken pox, smallpox, and mumps — all these and many other diseases are caused by germs. From reading this list you can easily understand that the greater part of the sickness that is in the world would disappear if the spread of disease germs from one person to another could be stopped.

Questions: 1. How does one person catch a disease from another? 2. Where do the germs that cause typhoid fever, diphtheria, smallpox, and other catching diseases come from? 3. Why do we not see disease germs? 4. Name some diseases that are caused by germs. 5. Which one of these diseases have you had? 6. Have you any of them now?

Suggestions and topics for development: Find out how many of the pupils' homes have been visited by some serious disease like typhoid fever or diphtheria, and in how many cases the disease has been allowed to spread to other members of the family. Drive home the idea that disease germs are organisms as definite as cows and horses; that every case of disease caused by them is due to taking the germs into the body; and that when one member of the family has a disease it is not necessary for the other members of the family to contract it.

Make a small, deep hole in the side of an apple and pack into it material from a rotten apple. Lay the apple aside for a couple of days and then cut it open. Show the class how the rot has entered the sound flesh of the apple.

Send to the Secretary of the State Board of Health at the state capital for bulletins, which will be found to contain splendid material for supplementing this and subsequent lessons. Distribute these bulletins to parents in case a communicable disease appears in your school.

CHAPTER TWENTY-NINE

TYPHOID FEVER

WHEREVER man makes his home, there is typhoid fever found. In the United States alone it attacks every year from a quarter to a half million people, and not an hour passes that some home is not left in sorrow because of it. Yet the cause of typhoid fever is well known. We know how the germs spread and how to prevent the disease. It is not necessary for us to sit idly by and year after year see it pass through the land striking down those who cross its path.

The typhoid germ. Typhoid germs leave the body in the wastes from the intestines and kidneys and sometimes in the sweat. They can live for some time (probably several weeks) in water, and it is thought that they can remain alive for several months in the soil. They can live frozen in ice for weeks, and in milk and some cooked foods they are able not only to live but to grow and multiply. They will die if they are thoroughly dried, and they can be killed with hot water.

How typhoid germs are scattered about. Typhoid germs have no legs to walk about with and no wings with which they can fly through the air. Everywhere they go they must be carried, but they are so very small that they can be carried about in many ways that we do not think of. The wastes from a typhoid patient may be thrown out on the ground and the germs washed into a stream. Miles

below where this is done, people may use the water from the stream and thus get the disease. Flies may walk over the wastes from a typhoid patient and carry on their feet thousands of the germs to food or to dishes. A person who is suffering with a light attack of the disease may handle milk and cause a great epidemic. Those who are sick with typhoid fever and those who take care of typhoid patients are almost sure to get the germs on their hands. These germs may then get into food; they may be left on pump handles or well buckets, on door knobs or wash basins. In any of these or a hundred other ways they may get on the hands and into the mouths of other persons.

FIG. 96. In 1906 Cincinnati used unfiltered water from the Ohio River and had 239 deaths from typhoid fever. In 1909 the water was filtered, and the deaths from typhoid fever dropped to 46.

Destroying the germs that come from those who have typhoid fever. Every one of the thousands and thousands of persons who have typhoid fever in our country every year is sick because he has swallowed typhoid germs that have come from some other person. To check the spread of the disease,

therefore, we must keep the germs from becoming scattered about. Every case of typhoid fever should be treated in the same way that a case of smallpox or of diphtheria is treated. No one should be about the patient except those who are taking care of him. All wastes that may contain the germs should be carefully destroyed (page 169). No flies should be allowed near the patient, for they may carry the germs about. Those who take care of the patient should wash their hands frequently in some disinfectant that will kill germs, and the dishes and drinking glasses used in the sickroom should be kept by themselves and boiled. The bedclothes should be changed often and boiled as soon as they are taken from the bed, and it should be remembered that any one who touches these clothes will probably get germs on his hands. It is only by keeping the germs from typhoid patients from becoming scattered about that we can hope to stop the spread of the disease.

Typhoid germ carriers. When a typhoid fever patient gets better, he should, if possible, be examined to see that he is free from germs before he again lives and eats with other members of the family. This is important, because just as a diphtheria patient often has the germs of the disease in his throat for several weeks or months after he is well, so in some cases typhoid fever patients carry the germs for weeks, months, or even years after they have

recovered from the disease. These germ carriers, because they are going about everywhere among other people, are more dangerous than are those who are really sick with the disease, and many cases of typhoid fever have been traced to them.

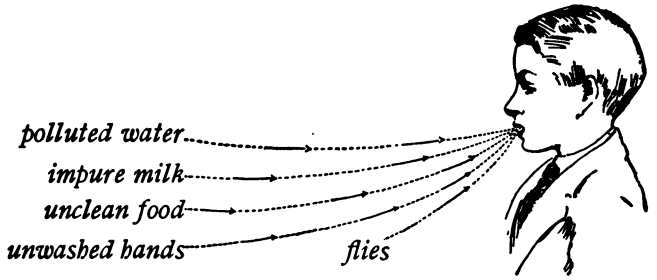


FIG. 97. By these paths typhoid germs reach the mouth. In the community in which you live, how could each path be blocked?

Protecting ourselves from typhoid germs. There are yet many cases of typhoid fever in our country in which the germs are not destroyed, and it is certain that we have many germ carriers among us. We must therefore take care to guard ourselves from typhoid germs that have become scattered abroad. These germs are likely to reach us in water, and if there is no other way of getting water that is considered safe by physicians, we should boil our drinking water. Typhoid germs are carried about by flies, and houses should be screened and the breeding places of flies removed (page 170). Food that has been exposed to flies

or handled by the public is unsafe, and infected milk is the cause of a great many cases of typhoid fever.

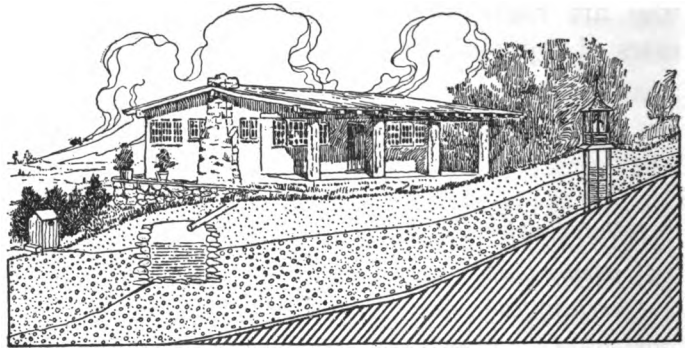


FIG. 98. In hilly and rocky regions, wells and springs may be infected by germs that are washed for long distances over layers of rock. In such regions the well should be on higher ground than anything about the place that may pollute it.

In general, typhoid germs reach us from the wastes and hands of typhoid patients and germ carriers, and we must guard the paths along which the germs can travel to us from these persons.

The germs of other intestinal diseases spread in the same ways that typhoid germs are spread. Dysentery (flux), diarrhœa, and cholera infantum (summer complaint) are caused by germs, and the germs of all these diseases are spread in about the same ways that typhoid germs are spread. Dysentery is a most dangerous disease, and cases of it should be carefully looked after to keep the germs

from reaching other persons. The intestinal diseases from which so many young children die in hot weather are caused to a great extent by germs taken in impure milk, but these germs can also be carried by water or by flies. A little baby should be kept away from other children that have the disease.

Questions: 1. How do typhoid germs leave the body? 2. Are typhoid germs hard to kill? 3. What are some of the ways in which they may be scattered? 4. What can we do to keep the disease from spreading? 5. What are some of the ways in which we can protect ourselves from typhoid germs? 6. What other disease germs are spread in the same way as typhoid germs?

Suggestions and topics for development: Discuss with the class the Rules for the Care of Typhoid Patients issued by your City or State Board of Health. Show that it is cheaper to use disinfectants liberally in case of typhoid fever than it is to allow other members of the family to become infected, as is often done. Find out the chief sources of infection in your community and discuss methods of avoiding infection. Teachers who live in rural communities should show how wells and springs are often infected by washing clothes where the drainage reaches them or by the hands of some one who is taking care of a typhoid patient. By multiplying the number of typhoid deaths in your city or state by 8 or 9, the approximate number of cases of the disease will be obtained. It is estimated that the direct cost of the average case in loss of time and medical fees is $240.

CHAPTER THIRTY

TUBERCULOSIS (CONSUMPTION)

FIG. 99. An open-air school for children who have tuberculosis. Most of the children in these schools improve in health at once. (*After a photograph in The Survey, March* 5, 1910.)

TUBERCULOSIS has spread itself through the whole world. In the warm tropics the people fall before it, and in the frost-bound regions of the earth it is well known. It finds its way into the mansions of the rich and it enters the cottages of the poor. It causes the death of one seventh of the human race, and in our own country one person in every ten dies of it. The germ that causes this disease may grow almost anywhere in the body, and we may have tuberculosis of the bones, of the kidneys, of the intestines, or of any other part of the body. By far the most common form of the disease, however,

is tuberculosis of the lungs, or consumption. This disease has long been called the Great White Plague, and the germ that causes it has been well named the Captain of the Men of Death.

Tuberculosis an expensive disease. Consumption is a long, lingering disease, and it often attacks people at the time of life when they are earning a living not only for themselves but for others as well. For these two reasons it is one of the greatest of all causes of poverty.[1] Exactly how much this disease costs our country in money it is not possible to say, but one estimate places the figure at a billion dollars a year.

The germ of tuberculosis. The germ of tuberculosis withstands drying longer than most germs, and in a damp or dark house it sometimes remains alive for months. It attacks many animals as well as man, and cattle especially suffer from this disease. It grows slowly, and usually the germ has been in the body for months before the disease shows itself. It gets into the body either by being breathed into the lungs or by being swallowed and carried through the body in the blood.

[1] In the city of Washington it was found that about one half of all the poverty in the city was due to sickness, and that as a cause of poverty consumption was far more important than any other disease. Every day in the United States tuberculosis makes orphans of over two hundred children under twelve years of age, and it has been found that out of every ten children in the county homes for children in Indiana, four are there because one or both parents have died or have become unable to work because of consumption.

Tuberculosis germs spread from consumptives and in milk. Tuberculosis germs do not grow in the fields and pastures. They are not found in the rain or on the leaves of the trees. They come from the people and from the cattle that have tuberculosis, and they get into our bodies by way of the mouth or the nose. This means that if we are to check the disease we must keep the germs from spreading from the people and the cattle that are carrying them.

FIG. 100. Of consumptives who begin treatment early in the disease, 76 in 100 recover or have the disease arrested. Of those who begin treatment in the late stages of the disease, only 19 in 100 recover or have the disease arrested. (*From the experience of the State Sanatorium at Rutland, Massachusetts.*)

How tuberculosis germs are spread from consumptives. Millions of germs are coughed up in a day by a consumptive and they are always in his mouth. If the patient is a careless one, the germs will surely get on his hands and clothes. They are left on drinking cups and dishes that are used by consumptives, they may be in food or milk that a consumptive has handled, or they may be left on pencils, books, door knobs, or on anything that he has touched. If the sputum is not carefully destroyed, the germs will be carried about by flies, they will get into drinking water, they will blow about in dust, and in many ways they will reach other

persons and start the disease in them. When a consumptive coughs he may send out into the air for several feet droplets of saliva that are full of germs. A consumptive therefore should hold a handkerchief or paper napkin before his mouth when he coughs, lest some other person breathe in the droplets and the germs that fly from his mouth.

Spitting a most dangerous habit. Spitting on floors, sidewalks, or similar places is a habit that is most dangerous to the health of a community. When tuberculosis germs are left in such a place, they are sure to be carried into houses on shoes and trailing skirts, they are blown about in the air in dust, they are carried by flies, and in many other ways they are spread where they cause sickness and death. Not more than half the people who have tuberculosis germs in their mouths know it, and no one should spit on the sidewalk, in the street car, or on the floor of a public building or private house.

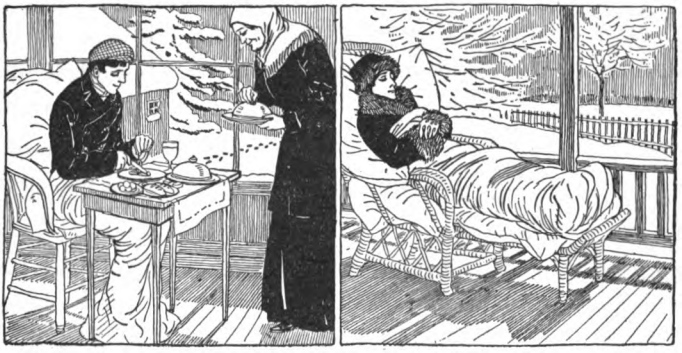
Germs from a consumptive should be destroyed. The first great point in preventing the spread of germs from a consumptive is to destroy the sputum. It should be received in a pasteboard cup or on a piece of cloth. This should then be burned, and not left where flies can get to it or where the germs may become scattered about in other ways. The dishes of a consumptive should

be kept separate from those of the rest of the family, and they should be boiled after each time that they are used. A consumptive should wash his hands occasionally in a disinfectant (page 169) to free them from germs. His handkerchiefs should be soaked in a disinfectant or kept in water until they can be boiled, and his clothes should be boiled before they are washed with other clothing. A consumptive always swallows some of the germs, and these are in the intestinal wastes. It is therefore necessary to keep these wastes covered from flies, to prevent their polluting drinking water, and to guard against their getting scattered on the earth about the homes of men.

Tuberculosis germs in milk. A considerable number of cattle have tuberculosis, and it is now known that many persons, especially children, get the disease from milk. All dairy cattle should be examined to see whether or not they have the disease. When milk is used from cattle that have not been examined, it is best to heat the milk to kill the germs in it. This will not only help to check tuberculosis, but will prevent a considerable amount of typhoid fever, diphtheria, scarlet fever, and other diseases that are spread by milk.

The importance of fresh air in the treatment of consumption. Every one should understand how important fresh air is in building up the body so that it can resist germs. There is little hope for

the consumptive who shuts himself up in the house and sleeps with his windows tightly closed. On the other hand, in the open-air schools that are run in some cities for children who have tuberculosis, and in sanatoria where the patients to a great extent



FIGS. 101 and 102. Good food, fresh air, and rest are very important in the treatment of consumption.

live and sleep in the open air, many consumptives are being cured of the disease. Every consumptive should have a light, airy room that will not only give him fresh air but will let in the sunlight to kill the germs in the room. He should also have some place like an upper porch where he can spend a great part of his time outdoors.

Food, rest, and a skilled physician important. To gain the strength that he needs, a consumptive must have an abundance of nourishing, well-prepared food. He should have rest and should

not exercise or work, or he will bring on fever in the afternoons. He should also have a skilled physician to guide him in his care of himself and to give him the medical attention that he needs. Climate is not very important in the treatment of consumption, but in general a cool, dry climate is best. One of the most important points of all is to begin the treatment while the disease is still in its early stages. Not only is consumption far easier to cure when it is in its first stages than later, but it can be cured in much less time and at much smaller cost.

Questions: 1. Explain the difference between tuberculosis and consumption. 2. How much does tuberculosis cost the people of the United States each year? 3. How does the germ of tuberculosis enter the body? 4. Where do tuberculosis germs come from? 5. Mention some ways by which the germs are spread from a consumptive. 6. Why is the habit of spitting a dangerous one? 7. How may the germs from a consumptive be destroyed? 8. What diseases besides tuberculosis are caused by milk? 9. How may the germs in milk be killed? 10. Where should a consumptive spend a great part of his time? 11. Mention other things that are important in the treatment of consumption. 12. Give two reasons why the treatment of consumption should be commenced at the earliest possible moment.

Suggestions and topics for development: Hygienic living as a preventive of tuberculosis. Pasteurizing milk. Disinfection of houses recently occupied by consumptives. Obtain Board of Health bulletins on tuberculosis and Knopf's *Tuberculosis as a Disease of the Masses and How to Combat It*. This book is published at cost (25 cents) by F. P. Flori, New York.

CHAPTER THIRTY-ONE

OTHER DISEASES OF THE AIR PASSAGES AND LUNGS

BESIDES consumption there are many other diseases of the air passages and lungs. The germs of all these diseases enter the body through the mouth and nose, and they are all spread by coughing, by spitting in public places, by the hands, by drinking cups, and in the various other ways by which the germs from a consumptive are scattered abroad.

FIG. 103. A drinking cup that had been in use in a school for nine days was examined and was estimated to have on each square inch of its surface 100,000 bacteria.

Pneumonia. Pneumonia causes more deaths in the United States than any other disease except tuberculosis. It is a catching disease, and no one should be about a pneumonia patient except those who are taking care of him. The sputum of a person who has the disease is filled with the germs and should be destroyed.

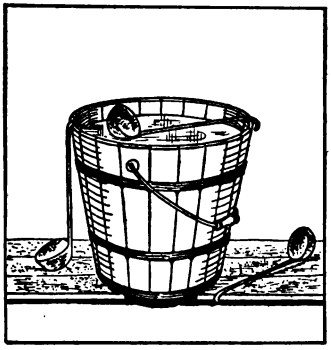
Diphtheria. This disease is caused by a germ that grows in the air passages, usually in the throat. Generally the disease shows itself in from one to three days after the germs get into the body. Many cases of diphtheria are so mild that they are mistaken for simple sore throat, but in other cases it is a very severe disease. Sometimes the germs remain in the throat of a diphtheria patient for weeks or even for months after he recovers. It is therefore

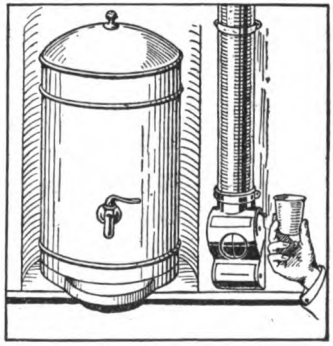
very important that a physician examine any one who has recovered from diphtheria to see if he is free from the germs before he is let out of quarantine. Some well persons who have been about those who have the disease may carry the germs in their throats although they themselves are not sick. For this reason those who are living in a family where there is diphtheria should be quarantined as well as the person who is sick, and when diphtheria breaks out in a school it is often necessary to examine all the children in the school and quarantine some who are carrying diphtheria germs, even when they are not sick. In the treatment of diphtheria nothing is so important as to give antitoxin at the earliest possible moment. The disease sometimes called membranous croup is diphtheria.

FIG. 104. Sanitary drinking fountains should be substituted for public drinking cups. In these fountains the person drinks the stream of water without touching the fountain with his lips.

Whooping cough. Whooping cough causes the death of great numbers of babies, and children should be protected from it. Usually the disease shows itself in from four to fourteen days after the

germs get into the body, but sometimes it does not appear for three weeks after the person has been exposed to the disease. It is a very catching disease, and at the first symptoms of it children should be removed from school. As a general rule a child may be allowed to return to school in six weeks after





FIGS. 105 and 106. In schools where the sanitary drinking fountain cannot be installed, a covered water cooler and individual cups should be substituted for the old-fashioned open bucket and common drinking cups.

the beginning of the whoop, provided the hard coughing spells have ceased.

Influenza (grip). This is a very severe and a very catching disease. The germs of it are spread in the same ways that the germs of consumption, diphtheria, and pneumonia are spread. Much can be done to check the spread of influenza by keeping the germs from spreading from those who are sick with it. How much can be done in this way was

shown in a school in Norwalk, Connecticut. This school had in it about twelve hundred pupils, when an epidemic of grip occurred in the city. On the second floor all the children who took the disease were sent home and the rooms were disinfected each night. On this floor only twenty pupils were attacked. On the first floor no care was taken to prevent the spread of the germs, and two thirds of the children had the disease. Old people and sick people should be very carefully protected from influenza germs, and no one should expose himself to them when he can avoid doing so.

Colds. Colds may be caused by the pneumonia germ, the influenza germ, or by a number of other germs. They are very catching, and the germs are spread in all the ways that influenza or pneumonia germs are spread. A child who has a bad cold should not be in school, and any one with a cold should do all in his power to keep the germs from spreading to others.

Protecting ourselves from the germs of respiratory diseases. Do not stay about those who have diseases of the lungs and air passages unless there is some special reason why you should do so. Do not handle objects that they have handled. Do not use drinking cups that they have used. Do not put pencils and other articles into your mouth. Avoid breathing in dust as much as possible (page 53). Keep your hands away from your face, and

wash them well with soap and water before eating. These are some of the ways by which you can keep the germs that cause diseases of the air passages and lungs from getting into your body.

Good health a great protection against germ diseases. When germs get into the body, the body tries to resist and kill them. There are a few germs like the germs of smallpox and measles that hardly any one can resist; but if we are in health we can often overcome the germs of diseases like pneumonia or colds. For this reason one of the best ways of protecting ourselves against these and many other germ diseases is to give our bodies good food, to keep our teeth clean and sound, to take plenty of sleep and exercise, and to make sure that we have an abundance of fresh air. We ought to do everything in our power to keep from taking the germs of consumption, pneumonia, influenza, and colds into our air passages, but these germs are so widespread that sooner or later we are bound to get them into our bodies. Then we will need to have our bodies so strong that they can defy the germs and kill them, and the only way to have a strong body is to give it continually the care that it needs.

Clean teeth a protection against germ diseases. Suppose there are two boys in the same school; that one of these boys has clean, sound teeth, and that the other boy has the other kind of teeth. Suppose

that a bad cold, grip, pneumonia or diphtheria appears in the school, and that each boy gets a few of the germs into his mouth. Which boy will probably have the better digestion, the stronger body, and be more able to fight off the germs? In which mouth will the germs be likely to grow and multiply until the boy can no longer resist them? Which boy is more likely to carry the germs for some time in his mouth, to have them on his hands, and to leave them on anything he handles? These are questions which it will not be hard for you to decide.

Questions: 1. In what ways do the germs of diseases of the air passages and lungs get into the body? 2. How can one prevent the scattering of germs from a patient sick with pneumonia? 3. What is the cause of diphtheria? 4. Why should a family in which there is a case of diphtheria be quarantined? 5. How long should children who have whooping cough be kept out of school and away from well children? 6. How are the germs of influenza spread? 7. Does getting wet cause a cold? 8. What is the best way to avoid influenza and colds? 9. What is the greatest protection against diseases of the air passages and the lungs?

Suggestions and topics for development: The necessity for quarantining all cases of diphtheria and for sending home all children who have communicable diseases. Discuss any habits the children may have that allow the germs of respiratory diseases to spread from one pupil to another. Discourage the passing of objects from one pupil to another, and put away common drinking cups, wash basins, and towels. The teacher should realize that the public school is a great disseminator of germ diseases, and should strive to make it as safe as possible for the children who attend it.

CHAPTER THIRTY-TWO

MALARIA, SMALLPOX, AND OTHER GERM DISEASES

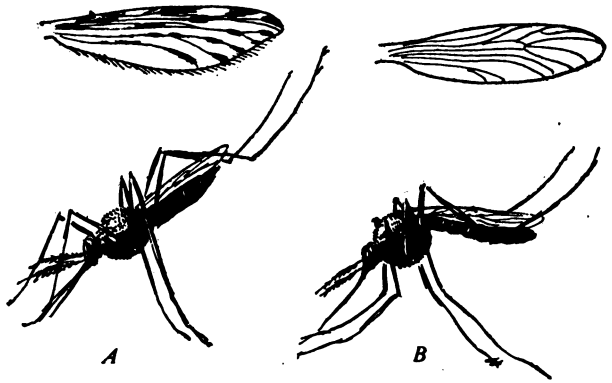


FIG. 107. The mosquito that carries malaria (*A*) has spots on its wings and stands up on its head when resting and biting. The common mosquito takes the position shown in *B*.

Malaria. The germ of malaria grows in the blood, and a person who is attacked by this disease may be troubled with it for months or years. One person cannot catch malaria from another person, but if a mosquito bites any one who has malaria germs in his blood, the mosquito gets the disease. Then, if the mosquito bites another person, it will leave the germs in the blood of the latter, and about a week later this person will have malaria. It was formerly thought that breathing air from swamps or drinking impure water caused malaria, but we now know that these ideas are not correct and that the disease is spread only by mosquitoes. In the next chapter we shall study how to destroy mosquitoes.

Smallpox. Smallpox was formerly one of the most feared of all diseases, because nearly every one who was exposed to it took the disease, and because a great number of those who were attacked by it died. A little over a hundred years ago it was found that a person could be protected against smallpox by vaccination. Now all that we have to do to escape the disease is to be vaccinated, and in countries where vaccination is practiced by all the people, smallpox is almost an unknown disease.

Scarlet fever. Scarlet fever is a very catching disease. The germs are in the scales that come from the skin and also in the discharges from the nose and mouth, and they can be scattered about in many ways. Scarlet fever is often dangerous and should be carefully quarantined. The disease usually appears in from two to ten days after the germs are taken into the body, but may not show itself for a much longer time. A patient is dangerous as long as the discharges from the eyes, ears, and nose continue. Usually cases of scarlet fever are quarantined for about fifty days.

Measles. Measles is a very catching disease. The matter from the nose and throat is especially dangerous, and the germs, like the germs of scarlet fever and smallpox, may be carried on clothing. No one with a cold should be allowed to come near a person who has measles, and the eyes should be shaded and carefully guarded during this disease.

A patient is usually dangerous to others for about three weeks after the time of the breaking out of the rash. The germs die out in a house in about two weeks. Measles ought to be carefully quarantined, for it is a most dangerous disease and causes about eight thousand deaths a year in the United States.

Mumps. One who has mumps is dangerous to others for about a week after the swelling has gone. The disease generally appears from thirteen to twenty days after the person has been exposed to the germs.

Boils and inflammation. Boils, carbuncles, pimples, bone felons, blood poisoning, and all inflammation in wounds and sores are caused by germs. Germs from a boil should not be allowed to reach other persons or the trouble may be spread. It is a common thing for a person with a boil to scratch the germs into the skin and bring on a whole crop of boils in other parts of his body.[1]

A cut or a sore should be tied up to keep germs from getting into it, and if particles of dirt have gotten into a wound they should be removed. Generally this can best be done by washing the wound with warm water, using when necessary a clean cloth rubbed on pure soap to wipe out the dirt. A fresh wound is often best treated by tying it up "in

[1] A physician reports that a young girl who was suffering with a boil visited four different girl friends in four different families, and in each case the girl visited was attacked by boils.

the blood" and not opening it until it has healed. Carbolated vaseline or borated vaseline is often useful in treating small wounds and sores that have matter in them.

Tetanus. The germ of tetanus or lockjaw lives in the earth, especially about horse stables. It

FIGS. 108 and 109. A little time spent in cleansing and caring for a wound may save trouble later.

grows best in small, deep wounds and in wounds that get earth and dust into them. Deep wounds made by rusty nails or other unclean objects should be cleansed by a physician. Wounds made by toy pistols and firecrackers are also likely to be followed by tetanus and should be cared for by a physician. An antitoxin for this disease has been prepared which is almost sure to prevent it if used in time. This is now often given after Fourth of July wounds.

Other germ diseases. Among other diseases that are caused by germs may be mentioned chicken pox, German measles, acute (inflammatory) rheumatism, meningitis, cholera, leprosy, plague, and yellow fever. Germs also cause many diseases of animals. One of these diseases is rabies or hydrophobia, which man sometimes gets from the bite or scratch of a dog or cat. Some persons think that dogs take rabies because of a lack of water or because of hot weather, but this is not correct. They may have the disease at any time of the year, and they get the germ from the bite of another animal that has the disease. The Pasteur treatment will almost always prevent rabies if it is begun in time.

Questions: 1. How are the germs of malaria carried from one person to another? 2. How are scarlet fever and measles spread from one person to another? 3. Why is it necessary to quarantine these diseases? 4. What is the cause of boils and pimples? 5. Why is one boil often followed after a few days by others on other parts of the body? 6. What is the best way of caring for wounds of the skin? 7. Why is a small, deep wound dangerous unless carefully cleaned? 8. What is the cause of rabies?

Suggestions and topics for development: The importance of screening malarial patients to prevent infection of the mosquitoes, and of screening houses and sleeping under mosquito nets in malarial countries. The importance of vaccination. The foolishness of allowing communicable diseases to run through schools, because they are regarded as not very severe. The teacher should secure health bulletins and become familiar with the symptoms of any infectious diseases that threaten the school.

CHAPTER THIRTY-THREE

PREVENTING THE SPREAD OF DISEASE GERMS

SOMETIMES a farmer finds thistles springing up in his pasture year after year, even when he has carefully cut down all the thistles that are on his own land. Then the farmer knows that some of his neighbors are raising thistles and allowing the wind to blow the seeds about. A thistle grows only from a thistle seed, and as long as they keep appearing in the pasture the seeds must come from somewhere.

Disease germs, like thistles, do not come from nowhere. Every case of typhoid fever is caused by germs that come from another case of typhoid fever. Every case of whooping cough is caused by germs that come from another case of whooping cough. Every case of grip is caused by germs that come from another case of grip. The people who have these and other catching diseases scatter the germs abroad just as a thistle scatters its seeds. One very important way of checking the spread of these diseases is to destroy the germs that come from sick people and not allow them to get spread abroad.

Disinfectants. A disinfectant is something that kills germs. Light and drying are two of nature's disinfectants that are great enemies of germs. Fire is one of the best disinfectants for sputum and articles of little value, and boiling water kills disease germs at once. Germs may also be killed by bichlorid of mercury, quicklime, carbolic acid, lysol, and other substances that can be purchased at drug

stores. Carbolic acid and lysol are good disinfectants. For intestinal wastes, a strong whitewash made of quicklime (slaked lime is useless) is cheap, and as good as anything that can be used. For furniture, floors, and the hands, bichlorid of mercury is often used, but it destroys metals. One of the best disinfectants for the hands and for objects that are made of metal is put up in tablets that contain biniodid of mercury and potassium iodid.

Mistakes in disinfecting. People often make a disinfectant too weak to injure the germs. For example, a few spoonfuls of carbolic acid are put into a bucketful of water, when a whole pint of the acid to a bucketful (ten quarts) of water is needed to make a disinfectant strong enough to kill germs. It is also a mistake to use too small an amount of a disinfectant, or not to allow the material to remain in it long enough to do the work. The rule followed in hospitals is to use as much disinfectant as there is material to be disinfected, and matter like intestinal wastes should be allowed to stand in the disinfectant for several hours.

The mistake of allowing germs to be scattered about a sickroom. One trouble in the sickroom is that the person nursing a case of some disease like typhoid fever works about the bed of the patient and then touches his own clothing or other articles in the room before disinfecting his hands. If this is done, the germs soon get on everything

in the room, and any one who even touches a door-knob, a chair, or a curtain in such a room is likely to get the germs on his hands. A basin of disinfectant should be kept close at hand, and the hands washed in it after doing any work that is likely to leave germs on them. Large aprons that will protect the clothing should be worn in the sickroom, and they should be changed frequently. Remember that germs are so small that fifty millions of them have plenty of room to swim in a drop of water, and that it requires great care to keep them from becoming scattered about.

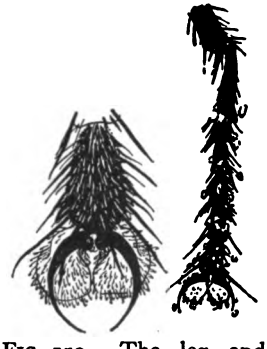


FIG. 110. The leg and foot of a fly as seen under a microscope. On their legs and feet flies often carry thousands of germs.

Keeping our houses free from flies. Flies are great carriers of disease germs, for they swarm about all manner of uncleanness, and then come into the house and walk over food and dishes, or on our very hands and faces. Houses should be screened, and everything possible should be done to keep flies out of them, but the best way to fight flies is to keep them from breeding about our homes.

The egg of the fly is laid in manure and sometimes in garbage. The egg hatches into a little white maggot, and in about ten days the maggot changes

into a fly. If all manure and garbage is hauled away and disposed of every week, or kept covered so that flies cannot get to it to lay their eggs, then the flies will have no place to hatch. If the people of a town should buy great numbers of incubators and hatch chickens in every yard, they would expect the chickens to become very abundant about them.

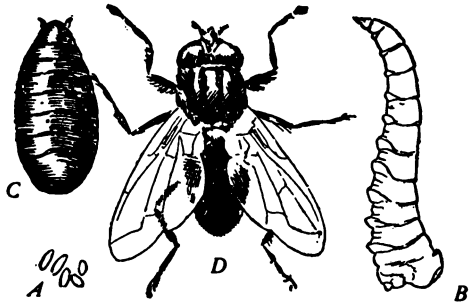


FIG. 111. The life history of the fly. *A* shows the eggs ; *B*, the larva or maggot; *C*, the pupa, and *D* the adult fly.

So if they keep incubators in the form of manure heaps for hatching flies, they must expect that the town will swarm with flies. Flies should not be allowed to get into the sickroom, nor should they be allowed to touch the germ-filled sputum and wastes that come from the sick.

Freeing our homes from mosquitoes. The egg of a mosquito is laid on water, and hatches into a wriggler. In hot weather the wriggler turns into a mosquito in about ten days. The best way to fight mosquitoes is to drain the pools of water, cover or

remove the rain barrels, screen or cover the cisterns, and carry away the old tin cans and buckets in which the mosquitoes hatch. The wrigglers and eggs in a pool or barrel can easily be killed by pouring kerosene on the water, and a water tank or barrel can be kept free from mosquitoes by putting a few minnows or other small fish into it. Some mosquitoes fly considerable distances, but the kinds that carry malaria and yellow fever spend their lives near the place where they are hatched, that is, within a few hundred yards of it. A town or a country house can easily free itself from disease-carrying mosquitoes by looking after the breeding places that are near it.

Impure water a carrier of disease germs. The germs that are most commonly taken into the body in water are the germs of typhoid fever and other diseases of the intestine. In diseases like pneumonia, diphtheria, grip, and consumption, however, the germs are swallowed, and are in the wastes from the intestine, and may be spread by water. Figure 96 shows how important it is for a city to provide a good water supply for its inhabitants, and any one who uses water from a private well or spring cannot take too much care in guarding his drinking water from disease germs.

Keeping germs out of a well or spring. In a mountainous country where the earth contains cracked and sloping layers of rock, germs can make their way through cracks in the rocks for long dis-

tances into wells and springs. Germs cannot pass through more than a few feet of soil, however, and in a level country where the wells are dug entirely through soil, germs can get into a well only at the mouth. They do this by getting on well-ropes and pumps from the fingers of germ carriers and the fin-

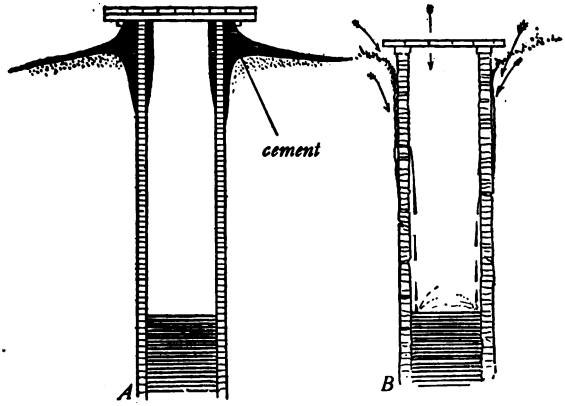


FIG. 112. *A* shows a well so arranged that surface water and germs are kept out of it. *B* shows how surface water and germs get into a well.

gers of those who have been waiting on the sick; from the feet of those who stand on the platform; from surface water that flows over the soil and runs down behind the wall into the well; or from clothes that are washed near the well. Arrange the covering of the well so that nothing can get into it at the mouth, for usually disease germs get into the well by this way and not from deep in the ground. A spring is never safe as long as surface water can flow into it,

and in rocky regions it is difficult to tell where the water of a spring comes from or when it is safe.

Disposing of the body wastes. Most disease germs that attack us grow either in the air passages and lungs, or in the mouth, throat, and intestine. These germs leave the body in the sputum and in the body wastes. It is unsafe therefore for people to spit in public places, and it is even more unsafe for the body wastes to be scattered about. These wastes should never be allowed to pollute the soil about houses; they should not be left where rains can wash them over yards and into wells and springs, and they should not be left where flies can carry them about. Perhaps no other one thing is so important to the health of the world as a safe method of disposing of human wastes.

Questions: 1. Where do disease germs come from? 2. What is a disinfectant? 3. Name some disinfectants. 4. What mistakes are often made in disinfecting? 5. How can we keep germs from getting on objects in a sickroom? 6. Explain where flies breed and how one can get rid of them. 7. What diseases are spread by water? 8. Explain how germs get into a well or spring and how to keep them out of it. 9. Where do germs grow in the body and how do they leave the body?

Suggestions and topics for development: Show the advantages of isolation, quarantine, and disinfection in dealing with infectious diseases. Show how many diseases have been eradicated by these measures and how the only hope of limiting the spread of certain diseases now prevalent lies along these lines. Make it

plain that disease germs do not get into a cistern from a hot, dry roof, but from the people who come about the cistern.

In nearly all village and rural communities the methods of disposing of excreta offer endless opportunities for infection with germs of all kinds and with intestinal worms. Show how the presence of germ-carriers renders imperative some sanitary method of disposing of human excreta.

Bulletins on The Housefly and The Mosquito can be obtained free from the Department of Agriculture, Washington, D. C. In regions where mosquitoes are very numerous, this repellant, recommended by the Department of Agriculture, may be found of use: one part cedar oil, two parts oil of citronella, two parts spirits of camphor.

CHAPTER THIRTY-FOUR

KEEPING UP THE RESISTANCE OF THE BODY TO DISEASE GERMS

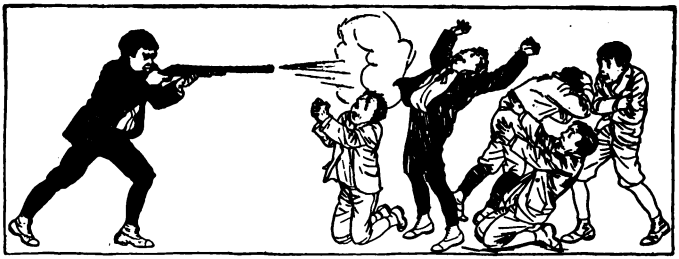


FIG. 113. People who would not think of killing their friends with a gun often kill them by carelessly scattering germs among them. In 1885 one man killed three thousand people by carrying smallpox germs from Chicago to Montreal.

IN a telephone exchange in Massachusetts employing over sixty girls, a record of the absences on account of sickness was kept for a number of years. The amount of sickness was greatest in the winter, when many of the girls suffered from colds and grip, and during the hot weather of July and August, when there was always considerable sickness from diseases of the digestive organs. Finally, a ventilator was put into the building. The first summer this was in use, the amount of sickness was not much affected, but when the second spell of hot summer weather came again the girls were not sick as they had been in other years. Breathing the pure air through a whole winter had so built up their strength and improved their health that they could resist the germs that caused the summer diseases. In the winter months themselves, the girls to a great extent es-

caped the colds from which they had suffered, and the amount of sickness for the winter was less than half what it had been before the ventilator was put into the building.

Building up the resistance of the body to disease germs. From the experience of the Massachusetts telephone company, we can learn two lessons. The first is that by living in a healthful way we can build up our bodies so that they will have a greater resistance to germ diseases. The other is that building up the body so that it can resist germs is not the work of a day or a week, but of months. We may take pneumonia or grip this year because last year we did not care for ourselves and so weakened our bodies. Hygienic habits of living are what we need at all times to help us in our fight with the germs.

The house and the health. Far more than most persons know, the houses in which we live affect the health. If a house is small, or too many people are crowded into it, it is impossible to keep the air pure. If there is only one place in the house where the teeth can be cleaned, probably the people who live in the house will often hurry off to work in the morning with uncleaned teeth. If there is no place in the bathroom but the wash basin in which to clean the teeth, no one will be able to wash his face without covering it with all the different kinds of germs that have been brought into the house.

If the floors are cold, the mother and the children who stay in the house all day will suffer and have their health injured. If the rooms are dark and damp, any germs that get into them will remain alive for weeks after they would have been dead in a dry, sunny room. The thing to do, therefore, if you are living in an unhealthful house, is to get out of it if you can, and if you must remain in it, arrange it so that it will be as easy as possible to live a healthful life. Avoid above everything being crowded together with other people, for the closer people live together, the more they trade germs with each other, and the harder it is to keep conditions about them healthful.

The community and the health of the citizen. If a man has a geranium, he has a right, if he wishes to do so, to put it in a cold, dark cellar and let it wither; but no man has a right to keep people in damp, dark, crowded houses in which women and children fade away and die. If a man has a barrel of apples, he has a right to put a rotten apple in the barrel; but no man has a right to go out and scatter abroad germs that may cause disease and death in other people. Therefore we have public health officers to guard the health of the whole people. It is right that we should have officers of this kind. It is right that they should see that people are not made to live in unhealthful houses or to work in unhygienic factories. It is right that health officers should insist

upon a town's having a pure water supply and a clean milk supply; that they should quarantine those who have diseases that are dangerous to others; and that they should require everyone to live so that he will not injure the health of others. It is the duty of every good citizen to assist the health officers in their work, for just as a house should be arranged so that it will be easy for those in it to lead a healthful life, so a community should be kept in such a condition that it will be as easy as possible for everyone in it to escape disease.

Questions: 1. What effect had ventilating the room in which they worked, on the girls of the Massachusetts telephone exchange? 2. What two lessons in hygiene can we learn from this? 3. Mention some hygienic faults sometimes found in houses. 4. Study the house in which you live and decide how it could be made a more healthful dwelling. 5. Why should we have public health officers?

Suggestions and topics for development: Lay great stress upon the importance of a hygienic environment. Often the badly heated, poorly ventilated schoolroom will offer a good starting point for practical suggestions. A schoolhouse that has a cold floor should have special attention.

TO THE TEACHER

THE teacher who uses this text will find Allen's *Civics and Health* (Ginn & Company, Boston), Shaw's *School Hygiene* (The Macmillan Company, New York), McVail's *The Prevention of Infectious Diseases* (The Macmillan Company), Lloyd and Bigelow's *The Teaching of Biology* (Longmans, Green & Company, New York), and Hutchinson's *Preventable Diseases* (Houghton, Mifflin & Company, Boston), most useful in giving a background for the teaching of the subject. McKenzie's *Exercise in Education and Medicine* (W. B. Saunders Company, Philadelphia), Harrington's *Practical Hygiene* (Lea and Febiger, Philadelphia), and Jordan's *Principles of Bacteriology* (W. B. Saunders Company), are books of a more advanced nature, but they can be profitably consulted by even the non-technical reader. Ritchie's *Primer of Sanitation* and *Human Physiology*, the second and third books of the series which includes this text, will furnish more detailed information in regard to many of the topics discussed, and the *Gulick Hygiene Series* (Ginn & Company), will be of service to the teacher. These or other similar books should be at the command of the teacher, for there can be little doubt of the truth of Spencer's dictum that hygiene is the most important subject in the schools and that it should yield to no subject in the care with which it is taught or in the time devoted to it.

INDEX

ACCIDENTS, what to do in case of, 127–130
Adenoids, 60–62; effects of, 61; frequency of, 60; importance of removal of, 61
Air, necessity for, 46
Air passages, 53; effects of dust on, 54; of tobacco smoke on, 56
Alcohol, an ally of tuberculosis, 105; not a brain stimulant, 103; and length of life, 106; attitude of employers toward, 107; attitude of medical men toward, 108; effects on body, 103–109; on digestive organs, 36; on heart, 66; on lungs, 57; on resistance to germ diseases, 105
Antidotes, for poisons, 129, 130
Antitoxin, in diphtheria, 158
Arsenic, antidote for poisoning by, 129

BACTERIA, cause of spoiling of food, 22; how they enter food, 23, 24; keeping out of food, 23; killed by heat, 24; by gastric juice, 28
Bathing, 75
Baths, cold, 76
Bichlorid of mercury, antidote for, 129
Bile, 29
Bleeding, how to stop from cuts, 66; from the nose, 67
Blood, 64, 65
Blood vessels, 64
Body, carriage of, 82–84; organs of, 5; parts of, 5
Boils, due to germs, 165
Bones, broken, care of, 127
Brain, effect of alcohol on, 103–105; work of, 92
Breathing exercises, directions for, 138–140; value of, 57
Breathing through mouth, evil effects of, 59
Breeding places of flies, 170–171; of mosquitoes, 171
Building foods, 10
Burns, care of, 127
Buying foods, 15–18

CANDY, harm done by, 35
Carbolic acid, antidote for, 129
Carbon dioxid, injurious to body, 47
Care of foods, 22–25
Chewing food, importance of, 33
Cholera infantum, how caused, 148
Clothing, 77–79; changing with weather changes, 78; effects of wet, 78; in cold weather, 77
Coarse foods, value of, 35
Coffee, use of, 33
Cold drinks, harm done by, 33
Colds, causes of, 160; restriction of, 160
Consumption, in dusty trades, 54. *See Tuberculosis*
Cooking, 19–21
Corrosive sublimate, antidote for, 129
Croup, membranous, 158
Cuts, how to bandage, 66

DEAFNESS, causes of, 123
Diarrhœa, how caused, 148; how spread, 148
Digestion, organs of, 26; process of, 27–30; in mouth, 27; in small intestine, 29; in stomach, 28
Digestive organs, keeping in health, 32–37
Diphtheria, 157; antitoxin in, 158; membranous croup a form of, 158; quarantine in, 158
Disease germs, 141–143; cause of catching diseases, 141; of running ears, 123; keeping out of

food, 24; list of diseases caused by, 142; size of, 142
Diseases of air passages and lungs, 157–160; of alimentary canal, 144–149
Disinfectants, 168; mistaken ideas about, 169
Drowning, what to do in apparent, 128
Dust, dangers of breathing, 53; keeping down, 54

EAR and its care, 121–126; danger from running, 123; foreign bodies in, 125; function of parts, 122; structure of, 122; treatment of running, 124
Eating, irregular habits of, 34
Enamel of teeth, how injured, 42
Esophagus, 27
Exercise, 86–89; an aid to digestion, 87; danger of over-exercising, 88; in the schoolroom, 88; proper position for, 131; rules in regard to, 87; violent, injurious, 65, 88
Exercises, breathing, 138; for arms, 132–134; for legs, 134–137; for trunk muscles, 137–138; for use in schools, 131–140
Eyes, avoiding diseases of, 118–119; care of the, 113–120; how moved, 114; how protected, 114; injury to, from poor light, 117; resting, 118; troubles of, in children, 116; danger of neglect, 116, 117

FAINTING, treatment of, 128
Farsightedness, 115
Fats, use in cooking, 20
Flies, as germ carriers, 170; of intestinal diseases, 148; of tuberculosis germs, 152–153; of typhoid germs, 145
Flux, how caused and spread, 148
Food preservatives, caution against, 24
Foods, as building material, 9; buying, 15–18; care of, 22–25; cooking, 19–21; as source of heat, 11; in treatment of tuberculosis, 155; unsafe when handled, 145; uses in the body, 9–13; use of fatty, 11
Fresh air treatment of consumption, 154

GASTRIC juice, 28
Germ, tuberculosis, in discharges of consumptive, 152, 154; how destroyed, 153; in milk, 154; how spread, 151, 152; typhoid, how to destroy, 145; how to protect ourselves from, 147; how spread, 144
Germs, diseases caused by, 141, 142, 167; cause of running ears, 123; of intestinal diseases, 148; keeping out of foods, 24; of respiratory diseases, protecting from, 160; preventing spread of, 168–175; of malaria, carried by mosquitoes, 163
Grip, 159–160; how to prevent spread of, 160

HABITS, and health, 99; importance of, 98–102; lasting, formed in youth, 101; seven hygienic, 99; mental, 100
Hair, care of the, 73; growth of, 73
Health, importance of, 2; great laws of, 7; good, a protection against germ diseases, 161
Hearing, testing the, 126
Heart, 63; work of the, 64; effect of alcohol on, 66; of tobacco on, 110

Heating foods, 11
Houses, effect on the health, 177–178
Hygiene, defined, 3

Illness, ascertaining amount of preventable, 3
Indigestion, causes of, 32–37
Inflammation, due to germs, 165
Influenza (grip), 159
Intestine, absorption from the small, 29, 30; digestion in the small, 29; function of the large, 30

Jimson weed, antidote for poisoning by, 130

Kidneys, 69–70; function of, 69; keeping in health, 70

Laudanum, antidote for poisoning by, 130
Light, for reading, 117, 118
Liquid at meals, 33
Lockjaw, antitoxin for, 167; how caused, 166
Lunches, indigestible, 35
Lungs, care of, 52–58; diseases of, 150–162; effects of alcohol on, 57; of tobacco smoke on, 56; functions of, 53; harmfulness of crowding, 55

Malaria, how caused, 163; how spread, 163, 172
Measles, 164; quarantine in, 165
Meningitis, cause of, 123
Mercuric chlorid, antidote for, 129
Milk, care of, 23, 24; carries germs of intestinal diseases, 148; of tuberculosis, 152; of typhoid, 145
Mosquito, carrier of malaria, 163; how to get rid of, 171
Mumps, care of, 165
Muscles, that hold body erect, 82; work of, 83

Nails, care of the, 74
Nearsightedness, 115
Nerves, work of, 90
Nervous system, 90–93; care of the, 94–97
Nightshade, antidote for poisoning by, 130

Opium, antidote for poisoning by, 130
Organs of body, the principal, 6
Outdoor sleeping, 50
Overeating, consequences of, 34
Over-exercising, dangers of, 65, 88
Oxygen, need of body for, 46

Pain, bad effects of suffering, 96
Pasteur treatment for rabies, 167
Pink eye, 118
Pneumonia, 157
Poison ivy, antidote for, 129
Poisons, antidotes for common, 129
Preventing spread of disease germs, 168–175

Quarantine, necessary in diphtheria, 158; in measles, 165

Rabies, cause of, 167; treatment of, 167
Resistance of body to disease germs, 176–179; increasing, 177
Respiration, artificial, 128
Rest, necessity for, 94; in tuberculosis, 155

Salivary glands, work of, 27, 28
Scarlet fever, 164
Selecting foods, 15–18; mistakes in, 15, 18
Sitting positions, good and bad, 85
Skeleton, function of the, 81

Skin, 71–76; as a regulator of body heat, 72; structure of the, 71
Sleep, necessity for, 95
Sleeping, outdoor, 50
Smallpox, 164; vaccination against, 164
Sound, how heard, 122; how produced, 122
Spinal column, function of, 82
Spinal cord, 90
Spitting, dangers of, 153, 174
Springs, how polluted, 172–173; keeping germs out of, 172
Sputum, dangerous in pneumonia, 157; in tuberculosis 152
Starchy foods, 11
Stomach, digestion in, 28
Sugar as food, 11

TEETH, care of the, 38–45; care of the first set, 43; causes of decay in, 41; decayed, cause of germ diseases, 39, 40; of ill health, 39; spread of decay in, 41; straightening irregular, 44
Tetanus, 166
Tobacco, effect on the body, 110–111; on digestive organs, 110; on the heart, 110; on the nervous system, 111; on scholarship, 111; a nuisance, 111
Tobacco smoke, effects on the lungs, 56
Tonsils, enlarged, effects of, 60–62; frequency of, 61; importance of treating, 61
Tuberculosis, 150–156; cause of, 151; a curable disease, 155–156; expense of, 151; germ of, 151; greatest cause of poverty, 151; importance of early treatment of, 156; number of deaths caused by, 150; spread by consumptives, 152; by milk, 152; germ, destruction of, 153; spread in milk, 154; by spitting, 153; in other ways, 152
Typhoid fever, 144–149; caused by germs from other cases, 145; number of cases yearly in United States, 144; a preventable disease, 144
Typhoid germ, carriers of, 146; destruction of, 145; flies, as carriers of, 145; life of, outside the body, 144; protecting ourselves from, 147; scattering of, 144; how to prevent, 145

VENTILATION, methods of, 48, 51; necessity for, 47; in sleeping rooms, 49
Ventilators, as reducers of disease, 176
Vision, tests of, 120

WASTES from body, how to dispose of safely, 174
Water, impure, a germ carrier, 172; keeping pure, 172
Well, how to keep germs out of, 172; how polluted, 173–174
Whooping cough, 158–159

YELLOW fever, spread by mosquitoes, 172